

The University of Chicago

THE FAUNA OF THE LITTLE SALINE
LIMESTONE IN STE. GENEVIEVE
COUNTY, MISSOURI

A DISSERTATION

SUBMITTED TO THE FACULTY
OF THE OGDEN GRADUATE SCHOOL OF SCIENCE
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

DEPARTMENT OF GEOLOGY

BY
GRACE ANNE STEWART

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Reprinted from
MISSOURI BUREAU OF GEOLOGY AND MINES, Vol. XVII, Second Series, Chap. IV
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CHAPTER IV

THE FAUNA OF THE LITTLE SALINE LIMESTONE IN
STE. GENEVIEVE COUNTY

by

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INTRODUCTION.

The Little Saline limestone is named from the Little Saline Creek in Ste. Genevieve County, Missouri, along the course of which the beds outcrop to a limited extent. The formation consists of a pure white, or faintly pink, crystalline limestone, some beds of which are replete with finely preserved fossils. From a detailed study of the fauna it is obvious that the formation may be divided into two horizons or zones, a lower one in which upper Oriskany species predominate with a few Helderbergian hold-overs, and an upper zone in which the upper Oriskany species are associated with some Onondagan forms.

The lower beds contain the larger portion of the fauna, for of the 102 species which have been identified, 77 occur here, with only 44 in the upper beds, 19 persisting through both horizons. Of the total number 26 species and 1 variety, or approximately 28 per cent of the entire fauna, belong to hitherto undescribed species.

The marked resemblance which exists between the Little Saline and the Oriskany fauna of the Appalachian trough, particularly in New York and Maryland, proves the contemporary age of the faunas, and the extension of the Oriskany sea into southeastern Missouri. The fauna was first discovered in 1913, and its presence in this region is of great interest, since its occurrence proves the westward extension of the typical Oriskany fauna for at least 500 miles further than was formerly supposed.

Typical upper Oriskany faunas have been recognized at a later date by C. O. Dunbar,¹ in western Tennessee, an occurrence which indicates a southward extension of the Oriskany sea for at least 200 miles.

The following correlation table shows the species which are present in the Little Saline limestone, and their occurrence elsewhere in the Appalachian trough and in Tennessee.

¹Dunbar, C. O., Geol. Surv. Tenn., Bull. 21, p. 68, 1919.

One of the important facts which is established by these tables, is the close relationship which exists between the Little Saline fauna, and that of the upper Oriskany of New York state, although some of the Missouri specimens do not attain so large a size as do examples of the same species in New York. Of the 102 which have been identified, 51 are the same or show close affinity with New York species, 18 of these with Helderbergian, 31 with Oriskany, and 8 with Onondagan species, this latter group all being present in the upper beds. These are: *Cystodicya cf. rigida*, *Dalmanella lenticularis*, *Stropheodonata cf. inequiradiata*, *Centronella glansfagea*, *Spirifer cf. varicosa*, *Platyceras dumosum*, *Ceratolichas gryps* and *Phacops cristata*.

Of almost equal importance is the relationship existing between the Little Saline fauna, and that from the Lower Devonian of Maryland, 44 species in all being definitely recognized as identical or closely allied. Of these 21 are Helderbergian, and 31 are Oriskany species. Notwithstanding the greater distance separating the two regions, a surprisingly close resemblance is also recognized between Little Saline fauna and that of the Grand Greve limestone of Gaspe in far eastern Quebec, eighteen species are definitely identified with Grand Greve forms, while 6 show a close resemblance.

Less decided, but still quite marked, is the relationship existing between the Little Saline fauna and that from the Lower Devonian of Tennessee. Eight species are identified with, or show an affinity with Linden forms (Helderbergian), while 16 are identifiable, with forms from the Harriman chert and Quall limestone (Oriskanian). The fact that the Missouri fauna bears a closer resemblance to that of the more distant Appalachian trough than to the closer Tennessean forms is surprising, since the entire trough seems to have served as a pathway for migration and environmental conditions within the limited southwestern part probably were similar.

FAUNAL TABLE.

	Missouri.		Gaspé.	New York.			Maryland.		Tennessee.	
	L. Little Saline	U. Little Saline		Helderberg	Oriskany	Onondagan	Helderberg	Oriskany	Linden	Hartman Quail
x—denotes occurrence. a—related species.										
<i>Anthozoa</i>										
1. <i>Zaphrentis cornuformis</i> sp. nov.	x									
2. <i>Zaphrentis salinensis</i> sp. nov.	x									
3. <i>Favosites</i> cf. <i>helderbergiae</i> Hall.	x									
4. <i>Favosites</i> sp. undet.	x									
<i>Crinoidea</i>										
5. <i>Edriocrinus</i> cf. <i>sacculus</i> Hall.	x									
<i>Bryozoa</i>										
6. <i>Fistulipora acutula</i> sp. nov.	x									
7. <i>Fistulipora variolata</i> sp. nov.	x									
8. <i>Meekopora</i> sp.		x								
9. <i>Heterotrypa undata</i> sp. nov.	x									
10. <i>Monotrypa</i> cf. <i>tabulata</i> Hall.	x									
11. <i>Unitrypa</i> cf. <i>lata</i> Hall.										
12. <i>Unitrypa subcircularis</i> sp. nov.										
13. <i>Polypora</i> cf. <i>hexagonalis</i> Hall.										
14. <i>Polypora media</i> sp. nov.										
15. <i>Polypora valida</i> sp. nov.										
16. <i>Cystodictya</i> cf. <i>rigida</i> Hall.										
<i>Brachiopoda</i>										
17. <i>Pholidops ovata</i> Hall.	x									
18. <i>Dalmanella lenticularis</i> (Vanuxem)										
19. <i>Dalmanella oriskania</i> sp. nov.	x	x								
20. <i>Rhipidomella emarginata</i> (Hall)	x	x								

FAUNAL TABLE—Continued.

	Missouri.		Gaspe.		New York.		Maryland.		Tennessee.	
	L. Little Saline	U. Little Saline	Grand Greve	Helderberg	Oriskany	Onondagan	Helderberg	Oriskany	Linden	Hartman Quail
21. <i>Rhipidomella musculosa</i> Hall.	x	x	x		x			x		
22. <i>Leptaena ventricosa</i> (Hall).	x	x			x			x		
23. <i>Stropheodonta missouriensis</i> sp. nov.	x							x		
24. <i>Stropheodonta cf. demissa</i> (Conrad).	x	x			a			a		
25. <i>Stropheodonta cf. inequiradiata</i> Hall.	x	x			x			x		
26. <i>Leptostrophia magnifica</i> (Hall).	x	x	x		x			x		
27. <i>Leptostrophia magniventra</i> Hall.	x	x	x		x			x		
28. <i>Brachyprion cf. majus</i> Clarke.	x	x	a		a			x		
29. <i>Brachyprion</i> sp.	x									
30. <i>Schuchertella</i> sp.	x									
31. <i>Anoplia nucleata</i> (Hall).	x	x			x					
32. <i>Chonostrophia complanata</i> (Hall).	x	x	x		x			x		
33. <i>Eatonia peculiaris</i> (Conrad).	x	x	x		x			x		
34. <i>Eatonis plicata</i> sp. nov.	x	x	x		x			x		
35. <i>Ucinulus parvus</i> sp. nov.		x								
36. <i>Ucinulus salinensis</i> sp. nov.	x									
37. <i>Ucinulus welleri</i> sp. nov.	x									
38. <i>Plethoryncha barrandii</i> (Hall).	x	x	x		x			x		
39. <i>Plethoryncha principalis</i> (Hall).	x	x			x					
40. <i>Centronella glansfagea</i> (Hall).	x	x								
41. <i>Rensselaeria ovoides</i> (Eaton).	x	x	x		x					
42. <i>Rensselaeria cf. stewarti</i> .	x	x								
43. <i>Beachia suessana</i> (Hall).	x	x								
44. <i>Beachia ovals</i> (Hall).	x									
45. <i>Atrypa reticularis</i> (Linne).	x	x								
46. <i>Spirifer arenosus</i> (Conrad).	x	x								
47. <i>Spirifer murchisoni</i> Castelnaui.	x	x								

x—denotes occurrence.

a—related species.

[illegible]

FAUNAL TABLE—Continued.

	Missouri.		Gaspe.	New York.			Maryland.		Tennessee.	
	L. Little	U. Little		Helderberg	Oriskany	Onondagan	Helderberg	Oriskany	Linden	Harriman
x—denotes occurrence. a—related species.										
<i>Pteropoda</i>										
84. Hyolithes cf. oxys Clarke.....	x		a							
85. Tentaculites elongatus Hall.....	x		x				x			
<i>Trilobita</i>										
86. Acidaspis sp. undet.....										
87. Proetus conradi Hall.....	x									
88. Proetus cf. pachydermatus Barrett.....	x		x		x					
89. Proetus protuberans Hall.....	x									
90. Lichas sp.....	x			x						
91. Ceratolichas gryps Hall.....		x				x				
92. Dalmanites cf. aspinosus Weller.....	x									
93. Dalmanites cf. bisignatus Clarke.....	x									
94. Dalmanites micrurus? (Green).....		x			a		a			
95. Dalmanites cf. pleuroptyx (Green).....	x		x							
96. Dalmanites slocomi sp. nov.....	x									
97. Dalmanites cf. stemmatus var. convergens Clarke.....		x								
98. Dalmanites sp. undet.....	x				x					
99. Dalmanites praenuntia sp. nov.....	x									
100. Cryphaeus sp.....		x								
101. Phacops cristata Hall.....		x								
102. Phacops sp.....		x								
Totals.....	77	44	24	18	31	8	21	31	8	16

The corals observed from this geological horizon are few, and form a minor portion of the fauna. Only four species have been identified, all from the lower beds. Of these two species belong to new and undescribed forms: *Zaphrentis cornuformis*, and *Zaphrentis salinensis*, and they seem to exhibit little resemblance to any previously described lower Devonian forms.

Thus far but a single well preserved Crinoid base has been noticed, belonging to the genus *Edriocrinus*.

Most of the bryozoans occur in the upper beds, and the relative abundance of the fenestellids and fistuliporids point to an early Devonian age for the fauna. Of the 11 species identified, 4 are present in the lower beds, and 8 in the upper, only one species, *Monotrypa tabulata*, ranging through both horizons. They have for the most part been replaced by lime carbonate, and their condition of preservation is such that identification is difficult and more or less uncertain. From a careful study of thin sections it has been possible to identify at least six new species, the others showing affinities with described forms occurring either above or below the Oriskany.

The brachiopods are chief among the classes represented, and form a large portion of the fauna, 43 species have been identified, which is approximately 43 per cent of the whole. Of these, eleven species, or about twenty-five per cent belong to new and hitherto undescribed species. Of the remainder, two do not admit of certain determination, twenty-three occur in the Oriskany of New York and Maryland, and the remainder occur either above or below this horizon.

The age of the fauna is suggested by the large size of the brachiopods, although generally speaking, they do not attain so large a size as do the New York examples. *Rensselaeria ovoides* is considerably smaller, although many of the mature forms are larger than *Rensselaeria marylandica*, which is the southern representative of this species in Maryland. An exfoliated portion of the pedicle valve of an exceptionally large *Leptostrophia magnifica* has been observed, and many smaller examples. It is particularly noticeable that the brachiopods are for the most part represented by the separate valves only, and except in one or two species entire specimens occur but rarely. Entire specimens of *Eatonia peculiaris* are present in a splendid state of preservation, and are common both in the lower and in the upper beds.

The characteristic *Atrypa reticularis* is but meagerly represented, and only in the upper beds. The cosmopolitan *Anoplothecca flabellites* is rarely present, and so far as known is restricted to the lower beds. *Spirifer arenosus* and *Spirifer munchisoni* are present in greater abundance. The Meristellid brachiopods show distinct differences from described forms, and are represented by at least four new species, which are restricted to the lower beds.

The following species of brachiopods range through both horizons: *Rhipidomella emarginata*, *Dalmanella oriskania*, *Rhipidomella musculosa*, *Leptaena ventricosa*, *Leptostrophia magnifica*, *Leptostrophia magniventra*, *Chonostrophia complanata*, *Eatonia peculiaris*, *Plethorhyncha principalis*, *Rensselaeria ovoides*, *Rensselaeria cf. stewarti*, *Spirifer arenosus* and *Spirifer munchisoni*.

A few fragments of Pelecypods occur in the lower beds but these present no diagnostic characters.

Quantitatively the gastropods come next in importance to the brachiopods. The assemblage is particularly characterized by the Platycerid type, and they present the characteristic lower Devonian aspect. They are for the most part restricted to the lower beds, 18 species occurring there, while only 6 occur in the upper. Only 3 species persist through both horizons. These are: *Platyceras nodosum*, *Platyceras planovolvis* and *Diaphorostoma ventricosa*. Of the 21 species which have been identified, five species and one variety are new, or approximately 28 per cent of the whole. Of the remainder, 10 occur in the Oriskany elsewhere, and 7 in the Helderbergian. One form, *Platyceras dumosum*, is an Onondagan species. Four of the species range through the Helderberg and the Oriskany. These are: *Platyceras gebhardi*, *Platyceras newberri*, *Platyceras reflexum* and *Diaphorostoma ventricosum*. One form, *Platyceras peregrinus*, belongs to that type of laterally compressed Platycerid shells, which is so common among the South American faunas.

The trilobites, although not represented by numerous individuals, belong to 17 different species. The specimens are all fragmentary, and not one entire example has been observed. Twelve species occur in the lower beds, and 7 in the upper, only 2 of these, *Proetus protuberans* and *Phacops cristata*, ranging through both horizons. Two new species have been described. Of the remainder, four occur in the Oriskany of New York and Maryland, seven in the Helderbergian of New York and Maryland, and two in the Onondagan of New York.

The material on which this study is based is preserved in the collections of Walker Museum of the University of Chicago. The writer wishes to acknowledge the helpful criticisms and suggestions of Professor Weller under whose constant supervision this paper has been prepared, and especially to acknowledge her indebtedness to him for the assistance given in the photographing of the specimens.

DESCRIPTIONS

COELENTERATA

Class ANTHOZOA

Subclass Tetracoralla

Family Zaphrentidae

Genus *Zaphrentis* Rafinesque

Zaphrentis cornuformis sp. nov.

Plate 57, figures 3-7.

Description—Corallite of medium size, simple, turbinate, commonly a little curved, rarely straight, the greatest curvature occurring near the apex; sides tapering gradually and uniformly, apex acute. The dimensions of the type specimen which is an average sized individual are: Length 85 mm., diameter of upper part of cup approximately 40 mm. Irregular wrinkled lines of growth give the shell an annulated appearance. Septa strongly marked on the exterior of the coral, about 85 in number where the diameter of the coral is 35 mm. A cross-section of the lower part of the cup shows the septa to be of equal length, almost reaching to the centre and not coalescing. A well-developed fossula occurs. Tabulae not observed, probably not well developed, or if present they have been poorly preserved. Character of cup obscure.

Remarks—This species may be distinguished easily from the other simple corals in the fauna, and likewise it is the most abundant. It differs from *Zaphrentis salinensis* in its more slender and tapering outline, in the distinct curvature of the sides, and it presents a less massive appearance. The septa are generally smaller.

Horizon—Lower beds.

Holotype and Paratypes No. 27552 Walker Museum.

Zaphrentis salinensis sp. nov.

Plate 57, figures 1, 2.

Description—Corallite simple, large, conical, sides straight, expanding gradually and uniformly. The dimensions of the type specimen are: Length about 80 mm., diameter of calyx approximately 55 mm. Tabulae not observed, possibly not strongly developed. Encircling lamellae are present on the part of the coral preserved. Septa about 90 where diameter of calyx is 45 mm. Length of septa, character of upper part of cup, and fossula not observed.

Remarks—One large incomplete example, and a smaller one, which appear to belong to this species, have come under observation.

Horizon—Lower beds.

Holotype and Paratype No. 27553 Walker Museum.

Subclass Hexacoralla

Suborder Tabulata

Family Favositidae

Genus Favosites

Favosites cf. helderbergiae Hall

Plate 57, figure 8.

1874. *Favosites helderbergiae* Hall, N. Y. State Mus., 26th Ann. Rept., p. 111.
 1887. *Favosites helderbergiae* Hall, Nat. Hist. N. Y. Pal., vol. 6, p. 8, pl. 4; figs. 1, 2; pl. 5, figs. 1-3; pl. 6, figs. 1-8.
 1913. *Favosites helderbergiae* Swartz, Geol. Surv. Md. Low. Dev., p. 208, pl. 22, fig. 1,

Description—"Corallum consisting of large, lenticular, depressed, convex or hemispherical masses; base covered by a strongly wrinkled epitheca. Cell tubes polygonal; their inner surface showing evidence of a few strong longitudinal striae. Septa frequent, from 10 to 15 in the space of 10 mm.; thickness equal to that of the cell walls. Mural pores in one or two ranges, comparatively large, circular, with margins distinctly elevated. Cell walls thin, but frequently much thickened near the surface by silicification, and sometimes granulose or spinose on the inner face. On some specimens the cells, at the surface, are nearly equal, having a diameter of about 1.5 mm.; on other specimens the diameter varies from .66 to 1.5 mm. On many of the specimens some of the cell tubes are larger and less angular than those surrounding them, being a little more than 2 mm. in diameter.—"Hall, 1887.

Remarks—A few specimens have been observed in the Little Saline limestone which are doubtfully referred to this species. The specimens are fragmentary and in no case show the hemispherical outline which characterizes the corallum of the species. The corallites are prismatic, polygonal, more rarely hexagonal. The mural pores are irregularly disposed, at least two rows being present. Longitudinal striae not observed. The diameter of the cell tubes varies considerably, some of them being as large as 2.5 mm. in diameter.

Horizon.—Lower beds.

Figured specimen No. 27554 Walker Museum.

Favosites sp. undet.

Plate 57, figures 9, 10

There are present in the collection studied, several impressions of the epitheca of the concave bases of the Favosites. They do not exhibit any diagnostic characters, and are recorded only to show the presence of this type of coral in the Little Saline limestone. A tentative comparison may be suggested with *Favosites foerstei* as figured by Dunbar, from the Tennessee beds, with this difference, that *Favosites foerstei* is characterized by convex bases, while the Little Saline form is concave.

Horizon—Lower beds.

Figured specimen No. 27551 Walker Museum.

ECHINODERMATA

Class CRINOIDEA

Order Indeterminate

Family Indeterminate

Genus *Edriocrinus* Hall*Edriocrinus cf. sacculus* Hall

Plate 57, figure 11.

1859. *Edriocrinus sacculus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 143, pl. 87, figs. 1-22, 1861.

1913. *Edriocrinus sacculus* Ohern, Geol. Surv., Md. Low. Dev. p. 256, pl. 40, figs. 7-12.

A single base of the *Edriocrinus* may be compared with this species. The concave depressions on the upper margin into which the radial plates fit are not clearly defined.

Horizon—Lower beds.

Figured specimen No. 27559 Walker Museum.

MULLUSCOIDEA

Class BRYOZOA

Order Cyclostomata

Family *Fistuliporidae*Genus *Fistulipora* McCoy*Fistulipora acutula* sp. nov.

Plate 58, figures 1, 2.

Description—Zoarium massive, under surface with a wrinkled epitheca; cells tubular, apertures somewhat irregular in outline, usually subcircular to oval; lunarium only slightly developed, and causing a slight angular protuberance of the peristome, the protuberances having the same general direction. Apertures fairly regularly and closely disposed, usually distant from one another from .25 to .75 mm. Cell walls thin. Vescicles angular, generally smaller than the cell apertures.

Cells tubular, cylindrical, characterized by numerous diaphragms which are oblique to the walls and convex upwards. Interstitial tissue abundantly developed, composed of vesicles irregularly disposed and not having the appearance of tubes divided by septa.

Surface characters not observed.

Remarks—This form may be distinguished from *Fistulipora variolata* by its less massive appearance, by the slighter development of the lunaria, and by the presence of diaphragms in the cell tubes.

Horizon—Lower beds.

Type specimen No. 27651 Walker Museum.

Fistulipora variolata sp. nov.

Plate 58, figures 3, 4.

Description—Zoarium massive, under surface with a concentrically wrinkled epitheca. Cells tubular, without diaphragms, apertures extremely irregular in outline, the

irregularity depending on the degree of development of the lunarium; disposition of the apertures also irregular, in some cases they are nearly touching, in others being as much as .75 mm. apart. Cell walls thin. Interspaces filled with vesicular tissue, vesicles angular, sometimes as large as the apertures but usually smaller.

A longitudinal section shows the abundant development of the interstitial tissue, and the irregularly shaped cell tubes. The vesicles are irregularly disposed in some places, but elsewhere are more regular and have the appearance of cylindrical tubes divided by septa.

Remarks—The distinguishing characteristics of this species are the extreme variation in the shape of the cell apertures caused by differences in the amount of development of the lunaria, and their irregular arrangement. This irregularity in disposition, and the large and numerous vesicles suggests a relationship with *Favosites parasitica* Hall, but that form is explanate or ramose, while the Little Saline forms are massive.

Horizon—Lower beds.

Type specimen No. 27650 Walker Museum.

Genus *Meekopora* Ulrich

Meekopora sp.

Plate 58, figures 5, 6.

Description—Zoarium lamellar, explanate, bifoliate; apertures obliquely inclined, apparently toward the distal margin of the branch, uniform in size, regularly spaced, about three occupying the space of one mm., margin of apertures slightly above the interspaces. Lunaria well developed, walls thin. A longitudinal section shows the bifoliate character of the zoarium, and the convex interspaces between the cell apertures; apertures broader than long. Diaphragms lacking.

Remarks—This form is especially characterized by the well developed lunaria. The fact that no diaphragms are present is peculiar since the presence of these structures is mentioned in the description of the genus.

Horizon—Upper beds.

Figured specimen No. 27652 Walker Museum.

Order Trepostomata

Suborder Amalgamata

Family Heterotrypidae

Genus *Heterotrypa* Nicholson

Heterotrypa undata sp. nov.

Plate 58, figures 7, 8.

Description—Zoarium ramose, branches bifurcating, their diameter about 20 mm. Zooecial apertures irregularly disposed, varying somewhat in size and shape, generally polygonal in outline, 3 to 4 occupying the space of 1 mm. Walls thick. Mesopores numerous, exhibiting considerable variety in size and shape and having no definite order of arrangement. A longitudinal section shows the mesopores to be well developed in the mature portion of the zoarium, but absent in the younger. The zooecial tubes grow upward from the base, then bend sharply outwards almost at right angles. Numerous diaphragms cross the zooecial tubes in the mature region, for the most part disposed irregularly, and in a few cases concave downward. Mesopore walls commonly undulating. Small, scattered, acanthopores are present.

Remarks—This species suggests some relationship to *Moticulipora* (*Heterotrypa*) *barrandii* Nicholson, of the Hamilton, but is characterized by thicker walls, more abundant mesopores, and undulating zooecial walls. Also there is a greater variation in the shape and size of the zooecia.

Horizon—Lower beds.

Holotype No. 27653 Walker Museum.

Suborder Integrata

Family Tematoporidae

Genus *Monotrypa* Nicholson

Monotrypa cf. *tabulata* Hall

Plate 59, figures 1-3.

1882. *Chaetetes? tabulatus* Hall, Rept. State. Geol. N. Y., pl. 9, figs. 12-15.

1887. *Chaetetes* (*Ptychonema*) *tabulatus* Hall and Simpson, Pal. N. Y., vol. 6, p. 14, pl. 9, figs. 12-15.

1913. *Monotrypa tabulata* Ulrich and Bassler, Geol. Surv., Md. Low. Dev., p. 278, pl. 50, figs. 1-4.

Description—Zoarium apparently in subspherical masses, having a diameter of from 40 to 45 mm. Zooecia closely crowded, irregularly polygonal in outline, sometimes hexagonal, usually about 3 in the space of 1 mm. Walls thin, in longitudinal section appearing extremely wavy, the undulations especially prominent in the mature region; diaphragms sparsely present. Mesopores and acanthopores absent.

Remarks—This is the most common bryozoa in the Little Saline limestone. The specimens exhibit the characteristic polygonal zooecia, and the corrugated walls of *Monotrypa tabulata* Hall, but differ in the presence of the diaphragms, and in having the undulations of the walls less persistent.

Horizon—Lower and upper beds.

Figured specimens No. 27658 Walker Museum.

Order Cryptostomata

Family Fenestellidae

Genus *Unitrypa* Hall

Unitrypa cf. *lata* Hall

Plate 59, figure 4

1883. *Fenestella* (*Hemitrypa*) *lata* Hall, Trans. Albany Institute, vol. 10, (abstract 1881, p. 34).

1885. *Unitrypa spatiosa* Hall (in error), Rept. of State Geol. N. Y. for 1884, pl. 2, fig. 12.

1887. *Fenestella* (*Unitrypa*) *lata* Hall and Simpson, Nat. Hist. N. Y. Pal., p. 136, pl. 52, figs. 1-10.

Description—Zoarium apparently infundibuliform, size unknown; branches of medium strength, width above a bifurcation .31 mm., increasing to .51 mm. below a bifurcation, straight, slightly rounded to flat on the reverse side, bifurcations infrequent. Interstices and branches of about equal width. Dissepiments slender, from one-half to the same width as the branches, more rounded, and frequently above the plane of the latter. Fenestrules oval, length from .60 to .75 mm., width from .25 to .30 mm., 11 to 12 occupy the space of 1 cm.

On the celluliferous side the branches are about the same strength as on the reverse side, 17 occurring in 1 cm. Fenestrules similar to those on the opposite face. Cell apertures in 2 ranges, sometimes 3 just before a bifurcation, slightly oblique to the axis of the branch, 16 in the space of 5 mm., separated by about half the diameter of an aperture, sub-circular in outline, sometimes crowded against fenestrules and indenting their borders.

A thin section reveals the superstructure, formed by the junction of the carinae and scalae. For a short distance the latter are oblique to the former, then gradually turn, until at the junction they are at right angles.

Remarks—This species resembles very closely *Unitrypa lata* Hall. In contrast the nodes common to that species have not been observed in any of the specimens studied, and the scalae are somewhat thicker, and the interstices wider than the scalae.

Horizon—Upper beds.

Figured specimen No. 27657 Walker Museum.

Unitrypa subcircularis sp. nov.

Plate 59, figures 5-7

Description—Zoarium infundibuliform, frond rapidly expanding, size unknown. Branches straight or slightly sinuous, flat, equal to or less than the width of the fenestrules, bifurcations frequent. Dissepiments strong, approximately the same width as the branches, slightly rounded on the reverse side, and on the same plane with them or a little depressed, expanded at their junction with the branches, 10 to 11 in the space of 1 cm. Fenestrules longitudinally oval, sometimes sub-circular.

On the celluliferous side the branches are straight to slightly sinuous, of equal strength with branches on the reverse side, 12 occupy the space of 1 cm., gradually expanding in width from .25 mm. above a bifurcation to .30 mm. below. Dissepiments about the same width as the branches or a little greater. Fenestrules elongate oval, length .75 to .90 mm., width about half as great, 11 occupy the space of 1 cm. Zooecial apertures in ranges of 2, 12 to 13 in 5 mm., oval in outline, separated by about half the diameter of an aperture.

Carinae connected by scalae form the superstructure. Interspaces sub-circular, greatest diameter .50 mm., scalae thick, carinated, 30 in the space of 1 cm., expanded considerably where they join the carinae.

Remarks—This species resembles *Unitrypa tegulata* Hall, but the apertures are more widely disposed than in that species.

Horizon—Upper beds.

Holotype No. 27655 Walker Museum.

Genus *Polypora* McCoy

Polypora cf. *hexagonalis* Hall

Plate 60, figures 1, 2

1883. *Fenestella hexagonalis* Hall, Trans. Albany Inst. 10, p. 169, (abstract 1881, p. 27).

1887. *Fenestella* (*Polypora*) *hexagonalis* Hall and Simpson, Pal. N. Y., vol. 6, p. 164, pl. 33, figs. 14-20.

Description—Zoarium apparently infundibuliform, size unknown. Surface essentially smooth on the reverse side. Branches of medium strength, sinuous, rounded, gradually enlarging from .40 mm. above a bifurcation to .90 before. Interstices wider than branches. Dissepiments rounded, about same strength as branches, and on the same plane, 3 present in the space of 5 mm. Fenestrules oval, outer rim hexagonal, length to width in proportion of 3 to 2.

On celluliferous side the branches are rounded, of uniform size near base of frond and enlarging gradually, reaching maximum width just before a bifurcation, rarely sinuous or anastomosing, bifurcation occurs regularly usually at intervals of 20 mm., width of branches just before a bifurcation .60 mm. Dissepiments strongly developed. Fenestrules elongate oval, width .45 mm., length approximately three times as great. Cell apertures in from two to four ranges, rarely five, 20 in the space of 5 mm. Shape not distinctly determined.

Remarks—This form has a greater number of apertures than *Polypora hexagonalis* Hall, and the dissepiments are not so distinctly carinated as in that species.

Horizon—Upper beds.

Figured specimen No. 27660 Walker Museum.

Polypora media sp. nov.

Plate 60, figure 3

Description—Zoarium infundibuliform, size unknown. Branches of medium strength on the obverse side, sinuous, rounded, sometimes slightly flattened, equal to about half the width of the interstices. Dissepiments about equalling the branches in strength, or slightly narrower, width from .60 to .70 mm., 4 in the space of 5 mm., flat to slightly rounded, on a plane with the branches. Surface granular. Fenestrules elliptical in outline, length usually about 1 mm., width from .50 to .60 mm.

On the celluliferous side the branches are less sinuous than on the reverse, gradually increasing in width from .40 to .80 mm. just before a bifurcation, 16 to 17 occupy the space of 1 cm. Dissepiments about the same strength as branches. Zooecial apertures in 2 to 4 ranges, 17 to 18 in 5 mm., separated by half the diameter of an aperture, sub-circular in outline, margins distinct.

Remarks—This species differs from *Polypora hexagonalis* Hall in having the apertures more widely disposed, in having a granular surface on the reverse side, and in showing no carinated dissepiments.

Horizon—Upper beds.

Holotype No 27659 Walker Museum.

Polypora valida sp. nov.

Plate 60, figures 4, 5

Description—Zoarium apparently infundibuliform, size unknown. Branches strong, straight, rounded slightly or sometimes almost flat, width above a bifurcation .50 mm., increasing to 1 mm. below a bifurcation. Dissepiments about one-half width of branches, on same plane as latter or a little depressed on the reverse side, 3 in the space of 5 mm. Fenestrules sub-triangular to oval, width .75 mm., length about twice as great, 6 occupy the space of 1 cm.

On the celluliferous side the fenestrules are elongate oval. Branches strong, 6 to 7 in 1 cm. Cell apertures in 4 to 5 ranges just below a bifurcation, and from 2 to 3 just above bifurcation, 20 present in 5 mm., circular to slightly oblong in outline, separated by less than half the width of an aperture. Both branches and dissepiments are covered with nodes, these being arranged regularly in parallel bands.

Remarks—This species may be differentiated from *Polypora hexagonalis* Hall, by the less sinuous branches, and by the greater number of branches. From the other associated species of this geological horizon it differs in having stronger branches, and in the presence of numerous nodes on the celluliferous side.

Horizon—Upper beds.

Holotype No. 27658 Walker Museum.

Family Cystodictyonidae

Genus Cystodictya Ulrich

Cystodictya cf. rigida (Hall)

Plate 60, figures 6, 7

1881. *Stictopora rigida* Hall, Trans. Albany Inst., vol. 10, abstract, p. 14.
 1883. *Stictopora rigida* Hall, Report of State Geologist for 1882, Expl. 25, figs. 15, 16.
 1887. *Stictopora rigida* Hall and Simpson, Nat. Hist. N. Y. Pal., vol. 6, p. 91, pl. 28, figs. 15, 16.

Description—Zoarium consisting of a flattened stipe, with straight, bifurcating branches; width of branches about 4 mm., just below bifurcation width increases to 5mm. Cell apertures oval, length about .30 mm., width about half as great. When split longitudinally and parallel to zoecial surface, the specimens show the mesathecal surface which is marked by sub-parallel, angular, and slightly undulating, longitudinal ridges.

Remarks—A single specimen showing the mesathecal surface has been observed, which resembles this Onondagan species. It differs in having somewhat wider branches, and in having transverse ridges not shown on specimens figured by Hall.

Horizon—Upper beds.

Figured specimen No. 27661 Walker Museum.

MOLLUSCOIDEA

Class BRACHIOPODA

Order Neotremata

Superfamily Craniacea

Family Craniidae

Genus Pholidops Hall

Pholidops ovata Hall

Plate 61, figures 1, 2

1859. *Pholidops ovatus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 490, pl. 103, b, fig. 7.
 1903. *Pholidops ovatus* Weller, Geol. Surv. N. J. Pal., vol. 3, pl. 226, pl. 20, figs. 27-29, p. 300.
 1913. *Pholidops ovata* Schuchert, Geol. Surv. Md. Low. Dev., p. 294, pl. 53, figs. 10-12.

Description—Shell small, circular to ovate. The dimensions of a pedicle valve are: length 2.5 mm., width 2 mm. Apex excentric. The fine concentric lamellae common to this species have not been noticed in the specimens which have come under my observation. An impression of the pedicle valve shows the well defined anterior muscle markings which extend nearly to the middle of the shell.

Remarks—This little form of attached brachiopod is represented by three dorsal valves only, and there appears to be no essential variation from the New York specimens.

Horizon—Lower beds.

Figured specimens No. 27483 Walker Museum.

Order Protremata

Superfamily Orthacea

Family Orthidae

Genus *Dalmanella* Hall and Clarke*Dalmanella lenticularis* (Vanuxem)

Plate 61, figures 9-11

1867. *Orthis lenticularis* Vanuxem, (non Wahlenberg), Geol. N. Y., Rept. Third Dist., 1842, p. 139, fig. 4. Hall, Nat. Hist. N. Y. Pal., 4, 1867, p. 35, pl. 5, figs. 1, 2.
1843. *Orthis lenticularis* and *O. lentiformis* Hall, Geol. New York, Rept. Fourth Dist., p. 17, fig. 4.
1889. *Orthis eboraensis* Miller, N. Amer. Geol. Pal., p. 357.
1892. *Dalmanella lenticularis* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 8, pt. 1, pp. 207, 224, pl. 5c, figs. 36-41.

Description—Shell of medium size, sub-elliptical to sub-ovate in outline, plano-convex, width greater than length or almost equal, the greatest width near the middle of the shell. The dimensions of a large pedicle valve are: Length 17 mm., width 19 mm. A small brachial valve measures 12 mm. in length, and 12.5 mm. in width. Cardinal extremities rounded.

Pedicle valve highly convex, the greatest convexity at or a little anterior to the umbonal region. Shell surface sloping gently to the lateral and anterior margins; beak small, blunt, incurved over the hinge line. Character of foramen not observed. A cast of the interior shows the long, narrow median septum extending from the beak almost to the anterior margin.

Brachial valve from depressed convex in the upper part to almost flat at the lateral margins; median portion marked by an ill-defined sinus which broadens out at the anterior margin forming a wide shallow depression. Beak small, projecting slightly beyond the hinge line.

Surface of both valves marked by fine, radiating, bifurcating costae of uniform size, the bifurcations as many as four in passing from beak to anterior margin; 5 costae occupy the space of 1 mm. Coarser imbricating concentric growth lines cross the striae.

Remarks—This characteristic Onondagan species is represented here by the separate valves only. In the essential features the specimens observed agree closely with those figured by Hall in the New York reports, with this exception, that in the Little Saline forms the costae maintain a more uniform size.

Horizon—Upper beds.

Figured specimens No. 27481 Walker Museum.

Dalmanella oriskania sp. nov.

Plate 61, figures 12-14

Description—Shell of medium size, length usually slightly greater than width, although a number of the specimens have the length and width practically the same. The type specimen, a pedicle valve, measures 20 mm. in length and 19 mm. in width. The shape varies from semi-elliptical to semi-circular.

Pedicle valve highly convex, elevated or carinated along the median line, the greatest elevation at the umbonal region. The surface of the shell slopes rather steeply to the lateral and cardinal margins, but more gradually towards the anterior margin. Cardinal margins meet the beak at an obtuse angle, extremities rounded. Beak small and slightly incurved over the hinge line.

Brachial valve sub-convex to flat, characterized by a mesial sinus which is narrow and deep near the beak, and broad and shallow toward the anterior margin. Cardinal margins make a more obtuse angle with the beak than in the opposite valve. Beak small and inconspicuous. A cast of the interior shows two elongate and narrow muscle scars separated by a deep groove.

Surface of both valves marked by radiating costae of uniform size, which bifurcate frequently; 4 occur in the space of 1 mm. at a point midway between the beak and anterior margin. These are crossed by coarser concentric lines of growth.

Remarks—This species resembles *Dalmanella subcarinata* Hall of the Lower Helderbergian beds, but is smaller, with the pedicle valve more highly convex and more elongated, and the cardinal margins meeting the beaks at a sharper angle.

Horizon—Lower and upper beds.

Holotype and Paratypes No. 27482 Walker Museum.

Family Rhipidomellidae

Genus Rhipidomella Oehlert

Rhipidomella emarginata (Hall)

Plate 61, figures 3-5

1859. *Orthis oblata* var. *emarginata* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 164, pl. 10a, figs. 4-6, 1861.

1913. *Rhipidomella emarginata* Maynard, Geol. Surv., Md. Low. Dev., p. 302, pl. 55, figs. 1-8.

Description—Shell small, a little broader than long, the hinge line less than the greatest width, from subtriangular to subcircular in outline. The dimensions of an average small individual are: Length 10 mm., width just below the middle of the shell 11 mm. The brachial valve of a larger form measures 13 mm. in length and 14 mm. in width.

Pedicle valve convex, the greatest convexity posterior to the middle, with a mesial sinus which is ill-defined near the beak, but becoming broad and more conspicuous toward the anterior margin. Hinge line straight, cardinal margins sloping abruptly from the beak, extremities rounded, giving the shell a circular outline.

Brachial valve more convex than the opposite, without well-defined fold; surface sloping uniformly from the middle to the anterior and lateral margins. Beak inconspicuous, slightly incurved below that of the opposite valve.

Surface of both valves covered with simple, radiating costae near the anterior margin, 3 occur in the space of 1 mm. These are crossed by coarser concentric growth lines, which are most prominent close to the anterior margin.

Remarks—This Helderbergian species is represented in the collection by one entire specimen, and a few separate valves. These are smaller than the forms figured from the Lower Helderbergian beds of New York, and the beak is less elevated.

Horizon—Lower and upper beds.

Figured specimens No. 27480 Walker Museum.

Rhipidomella musculosa Hall

Plate 61, figures 6-8.

1857. *Orthis musculosa* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 46.

1859. *Orthis musculosa* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 409, pl. 91, figs. 1-3; pl. 95, figs. 1-7, 1861.

1892. *Rhipidomella musculosa* Hall and Clarke, *ibidem*, vol. 8, pt. 1, pp. 190, 210, 225, pl. 6a, fig. 5.

1908. *Rhipidomella musculosa* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 201, pl. 42, figs. 1-5; pl. 43, figs. 14, 17, 19, 20, 22.
1913. *Rhipidomella musculosa* Schuchert, Geol. Surv., Md. Low. Dev., p. 305, pl. 55, fig. 20; pl. 56, figs. 1-4.

Description—Shell attaining a rather large size in mature examples, slightly broader than long. The dimensions of an average sized individual are: Length 35 to 36 mm., width 37 mm. Suborbicular in outline, hinge line short.

Pedicle valve depressed convex, flattened towards the anterior and lateral margins from the umbonal region. Beak small and slightly incurved above the hinge line. The muscular scars are strongly developed, large, fan-shaped, and extend well beyond the middle of the shell. Pallial region prominent.

Brachial valve much more convex than the pedicle, the surface sloping gently toward the lateral margins, and more abruptly toward the anterior margin.

Surface of both valves marked by fine radiating costae about 3 occupying the space of 1 mm. Concentric lines of growth also cross both valves, and appear to be more prominent on the pedicle valve, especially near the anterior margin.

Remarks—This is one of the less common species of the fauna, and all the specimens examined are separate valves.

Horizon—Lower and upper beds.

Figured specimens No. 27479 Walker Museum.

Superfamily Strophomenacea

Family Strophomenidae

Genus *Leptaena* Dalman

Leptaena ventricosa (Hall)

Plate 61, figures 15-17.

1857. *Strophomena depressa* var. *ventricosa* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 55.
1859. *Strophomena rugose* var. *ventricosa* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 417, pl. 94, figs. 2e, 2f, 3.
1892. *Leptaena rhomboidalis* var. *ventricosa* Hall and Clarke, *ibidem*, vol. 8, pt. 1, pl. 15a, fig. 43.
1908. *Leptaena rhomboidalis* var. *ventricosa* Clarke, N. Y. State Mus., Mem. 9, pt. 2, p. 87, pl. 21, fig. 87.
1913. *Leptaena rhomboidalis* var. *ventricosa* Schuchert, Geol. Surv., Md. Low. Dev., p. 309, pl. 56, fig. 18; pl. 57, fig. 1.

Description—Shell semi-circular to semi-oval in outline, sometimes attaining large size. Width commonly somewhat greater than the length, but in some examples the dimensions are nearly equal. The hinge line is equal to the greatest width of the shell, and the extremities are extended into conspicuous auricular projections in some cases. The dimensions of the pedicle valve of a large individual are: Length 39 mm., width 40 mm. A smaller shell measures 32 mm. in length and 34 mm. in width.

Pedicle valve extremely ventricose, the greatest convexity anterior to the middle of the shell, and from here the surface slopes abruptly toward the anterior margin, and less abruptly towards the lateral margins; above the maximum convexity the surface slopes uniformly to the hinge line. Surface marked by several large concentric wrinkles, which gradually decrease in size toward the beak, the last two or three being quite indistinct. Beak rounded and slightly incurved over the hinge line. A cast of the interior shows the strongly marked, fan-shaped muscular imprints, divided longitudinally by a median depression.

Brachial valve slopes gently from the hinge to the front, near which it becomes abruptly deflected causing a deep concavity. Concave area marked by concentric wrinkles which are less pronounced than those on the opposite valve. Beak small and inconspicuous. The interior casts show the strongly-marked, longitudinal muscular impressions.

Surface of both valves marked by fine, radiating costae, there being 2 or 3 present in the space of 1 mm.

Remarks—This characteristic Oriskany species occurs abundantly in the Little Saline beds, and is only represented by the separate valves in the collection studied. It differs from *Leptaena rhomboidalis* Hall, in the greater ventricosity of the pedicle valve, in its larger size, and in the more strongly marked muscular imprints. The same species occurs in the Oriskany sandstone of New York, and in the Oriskany beds of the Gaspé region, Canada.

Horizon—Lower and upper beds.

Figured specimens No. 27478 Walker museum.

Genus *Stropheodonta* Hall

Stropheodonta missouriensis sp. nov.

Plate 61, figures 21-22.

Description—Shell large, semi-circular in outline, width commonly greater than the length, the greatest width anterior to the middle of the shell. The dimensions of two brachial valves, the holotype and paratype, are: Length 38 mm., width 45 mm., and length 34 mm., width 40 mm.

Brachial valve gently concave to about 8 mm. from the anterior and lateral margins, where it becomes abruptly deflected upwards. This abrupt deflection is distinctly marked on the internal casts of the valves. Hinge line straight, finely crenulated, shorter than the greatest width of the shell. Cardinal extremities rounded. An impression of the interior shows part of the cardinal process, and the elongate septum extending more than half way to the anterior margin. Surface marked by fine, closely arranged, radiating striae.

Pedicle valve unknown.

Remarks—There are present in the collection studied only the interior and exterior impressions of the brachial valve. The form somewhat resembles *Strophodonta lincklaeni* Hall, but is proportionately smaller, has a more pronounced semi-circular outline, more extended cardinal extremities, and with the hinge line shorter than the greatest width of the shell, and lacks the curvature of the lateral margins just below the cardinal angles.

Horizon—Lower beds.

Holotype and Paratype No. 27475 Walker Museum.

Stropheodonta cf. demissa (Conrad)

Plate 61, figure 18.

- 1842. *Strophomena demissa* Conrad, Jour. Acad. Nat. Sci., Phila., vol. 8, pl. 258, pl. 14, fig. 14.
- 1867. *Strophodonta demissa* Hall, Nat. Hist. N. Y. Pal., vol. 4, pp. 81, 101, pl. 11, figs. 14-17; pl. 12, figs. 1-5.
- 1913. *Stropheodonta demissa* Schuchert, Geol. Surv., Md. Low. Dev., p. 313, pl. 57, fig. 11.

Description—The only specimen referable to this species, a pedicle valve, is not entirely preserved and the identification is somewhat uncertain. Shell of medium size, sub-circular in outline, regularly and strongly concave. The dimensions are: Length

22 mm., width 26 mm. Hinge line long and straight, and equal to the greatest width of the shell. Surface marked with prominent, radiating, nodose costae, which increase by bifurcation and present a somewhat bunched and uneven appearance.

Remarks—This form has the general outline of *Stropheodonta demissa* Conrad, and the characteristic surface markings, but is more distinctly concave.

Horizon—Lower beds.

Figured specimens No. 27477 Walker Museum.

Stropheodonta cf. inequiradiata Hall

Plate 61, figures 19-20.

1887. *Strophomena (Strophodonta) inequiradiata* Hall, Tenth Rept. N. Y. State Cab. Nat. Hist., p. 113, figs. 1-3.
 1861. *Strophomena inequistriata* Billings, Can. Jour. Sci. Arts, 6, p. 338, fig. 113. Geol. of Canada, 1863, p. 367, fig. 375.
 Pal. Fossils, 2, 1874, p. 24, fig. 13; pl. 2, fig. 4, p. 240.
 1867. *Strophodonta inequiradiata* Hall, Pal. N. Y. vol. 4, p. 87, pl. 11, figs. 24-31; pl. 12, fig. 12; pl. 13, figs. 6-11.
 Second Ann. Rept. N. Y. State Geol., 1883, pl. 45, figs. 13-14.
 Walcott, Mon. U. S. G. S., vol. 8, 1884, p. 120, pl. 11, fig. 11.
 1892. *Stropheodonta inequiradiata* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 8, pt. 1, pl. 14, figs. 13-14.

Two pedicle valves of a *Stropheodonta* have been observed which bear a marked resemblance to this Onondagan species. They are smaller than those figured in the New York reports, but exhibit the same semi-circular outline, high convexity, and the characteristic uneven and variable costae.

Horizon—Upper beds.

Figured specimens No. 27476 Walker Museum.

Genus *Leptostrophia* Hall and Clarke

Leptostrophia magnifica (Hall)

Plate 62, figures 1-3.

1857. *Strophodonta magnifica* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., pl. 54.
 1859. *Strophodonta magnifica* Hall, Nat. Hist. N. Y. Pal., vol. 3, pp. 414, 482, pl. 93, fig. 4; pl. 94, figs. 2a-2d; pl. 95, fig. 8; pl. 95a, figs. 15-19.
 1859. *Strophodonta vascularia* Hall, *ibidem*, vol. 3, p. 412, pl. 92, fig. 4; pl. 95, fig. 10 (not pl. 93, figs. 2b, 2c=? *S. magniventra*), 1861.
 1861. *Strophomena magnifica* Billings, Can. Jour. Sci. Arts, vol. 6, p. 348.
 1863. *Strophomena magnifica* Billings, Geol. Canada, p. 961, fig. 468.
 1883. *Strophodonta magnifica* Hall, Second Ann. Rept. N. Y. State Geol., pl. 44, figs. 27-28.
 1892. *Stropheodonta (Leptostrophia) magnifica* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 8, pt. I, p. 288, pl. 13, figs. 27-28.
 1900. *Leptostrophia magnifica* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 53, p. 7, fig. 36.
 1908. *Leptostrophia magnifica* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, pp. 190-191, pl. 38, figs. 1-2; pl. 39, figs. 9-10.
 1913. *Stropheodonta (Leptostrophia) magnifica* Schuchert, Geol. Surv., Md. Low. Dev., p. 318, pl. 58, figs. 2-5.

Description—Shell varying in size from medium to large, more or less semi-oval in shape, cardinal extremities usually well rounded, width a little greater than length,

or in some examples the length and width equal. The pedicle valve of an average sized individual measures 45 mm. from beak to anterior margin, and 50 mm. across the greatest width. The largest individual observed measures 75 mm. in length and 80 mm. in width.

Pedicle valve regularly convex, without median sinus. Beak flattened, inconspicuous, scarcely incurved over the hinge line. In the older individuals the surface of the shell in the pallial region is folded to form broad wrinkles. Large longitudinal muscle impressions are conspicuous in the casts of the interior, the divisions being marked off by distinct grooves, the whole scar fan-shape in outline.

Brachial valve from flat to slightly concave. The surface of the vascular area is characterized by numerous pustulose elevations, irregularly arranged, and which become faint towards the margins. The impressions of the two adductor muscle scars are sub-reniform in outline, and are separated by a low, rounded ridge.

The entire surface of both valves is marked by fine, radiating slightly flattened costae, with coarser concentric lines of growth crossing them. The costae vary considerably in size, and increase by bifurcation and intercalation, the additions being most conspicuous a little below the beak. In exfoliated portions of the shell a distinct pitted structure is apparent, the pits arranged in longitudinal rows parallel to the striae.

Remarks—This species occurs abundantly in the Little Saline limestone, and is represented by separate valves only, pedicle valves and their casts being most frequent. The specimens agree closely with those from the Oriskany of New York and attain a similar size.

Horizon—Lower and upper beds.

Figured specimens No. 27474 Walker Museum.

Leptostrophia magniventra Hall

Plate 62, figures 4-5.

- 1857. *Strophodonta magniventra* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist. p. 54.
- 1859. *Strophodonta magniventra* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 411, pl. 92, figs. 2a-2c, 3; pl. 95, fig. 9, 1861.
- 1859. ?*Strophodonta lincklaeni* Hall, Nat. Hist. N. Y. Pal., vol. 3, pl. 93, fig. 2a (not figs. 3a, 3b=*S. lincklaeni*).
- 1859. *Strophodonta vascularia* Hall, Nat. Hist. N. Y. Pal., vol. 3, pl. 93, figs. 2b, 2c (not pl. 92, fig. 4; pl. 95, fig. 10=*S. magnifica*) 1861.
- 1861. *Strophomena magniventra* Billings, Can. Jour. Sci. Arts, vol. 6, p. 349.
- 1863. *Strophomena magniventra* Billings, Geol. Can., p. 961, fig. 469.
- 1874. *Strophomena magniventra* Billings, Pal. Fossils, vol. 2, p. 22, figs. 10-12, pl. 2, figs. 2-2a.
- 1892. *Stropheodonta* (*Leptostrophia*) *magniventra* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 8, pt. 1, p. 288, pl. 13, figs. 25-26.
- 1900. *Stropheodonta lincklaeni* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 52, pl. 7, fig. 37.
- 1913. *Stropheodonta* (*Leptostrophia*) *magniventra* Schuchert, Geol. Surv., Md. Low. Dev., p. 319, pl. 58, figs. 6-8.

Description—Shell elongate oval to semi-circular in outline, relative length and width variable. The dimensions of the only complete mature pedicle valve observed are: Length 41 mm., width 49 mm. The pedicle valve of a larger and probably older individual measures 50 mm. in length and approximately 60 mm. in width.

Pedicle valve of medium convexity, the surface sloping gradually and uniformly to the lateral and anterior margins with no fold or sinus. Hinge line slightly less than the greatest width of the shell, the greatest width a little posterior to the middle of the

shell. Beak broad, rounded, but little incurved. Crenulations on hinge line obscure. Cardinal extremities obtuse.

Surface marked with numerous, fine, rounded, radiating, bifurcating costae, which are separated by broader, flatter interspaces; in the middle of the shell 2 costae occupy the space of 1 mm. An exfoliated portion of the shell shows the elongate oval adductor muscle impressions, and the large, plicated fan-shaped diductor muscular markings.

Hall describes the brachial valve as follows: "Dorsal valve (of this species) deeply concave, radiatingly striated, the striae finer than those of the ventral valve. The interior of the valve is marked by well-defined muscular areas; and outside of these the vascular and ovarian spaces occupy a large part of the shell, having a well-defined semi-elliptical area of a width little greater than the length, and somewhat contracted at the cardinal angles. The margin outside of the vascular area is striate-punctate."—Hall, 1859.

Remarks—One complete pedicle valve and three imperfect ones have come under my observation. None of the specimens show the elongated hinge line which characterizes some of the New York specimens. Swartz says: "*Stropheodonta magniventra* is easily distinguished from all associated *Stropheodonta* by its external ornamentation, i. e., by the few widely separated obscure striae on the ventral valve, and by the very delicate and exceedingly numerous striae of the dorsal valve. Another feature is the very high ventral cardinal area."—Swartz, 1913.

Horizon—Lower and upper beds.

Figured specimens No. 27473 Walker Museum.

Genus *Brachyprion* Shaler

Brachyprion cf. majus Clarke

Plate 62, figures 6, 7.

1874. *Strophomena inequiradiata* Billings, Pal. Fossils, vol. 2, pt. 1, p. 24 (not fig. 13), pl. 2, fig. 4.
 1900. *Brachyprion majus* Clarke, Mem. N. Y. State Mus., vol. 3, p. 54, pl. 8, figs. 8-13.
 1908. *Brachyprion majus* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 190, pl. 36, figs. 1-6.

Description—Shell of medium size, semi-circular to semi-elliptical in outline; length greater than width. The dimensions of the separate brachial and pedicle valves of different individuals are: Length 20 mm., width 28 mm., and length 16 mm., width 22 mm. The hinge line equals the greatest width of the shell, and is finely denticulate for about half its length.

Pedicle valve moderately convex, umbonal region broad and sloping abruptly to the posterior margin. Beak slightly elevated, flattened and incurved over the hinge line. Cardinal extremities sharply defined.

An interior of the brachial valve shows the valve to be moderately concave with a well defined mesial sinus which broadens a little toward the anterior margin. The surface exhibits a regularly marked pustulose character.

Surface of both valves marked by fine, radiating, irregular costae. These vary in size and increase by interstitial addition and by bifurcation, producing a fasciculate appearance. These are crossed by fine, concentric markings which have been poorly preserved in the specimens observed.

Remarks—The species is sparingly represented by one doubtful pedicle valve, and the internal casts of a few brachial valves. The form bears a stronger resemblance to *Brachyprion majus* Clarke of the Grand Greve limestone, Quebec, Canada, than to the same species in the Oriskany of Becraft mountain, New York. In the apparently mature forms the irregularity of the surface markings still persists giving the fasciculate appear-

ance, while in the New York specimens this is a feature of the immature forms only. The Little Saline specimens are considerably smaller than those from Quebec.

Horizon—Lower beds.

Figured specimens No. 27472 Walker Museum.

Brachyprion sp.

Plate 62, figures 8-10.

Description—Shell small, semi-circular to elongate oval. The dimensions of two brachial valves are: Length 12 mm., width 13 mm., and length 10 mm., width 11 mm.

Brachial valve deeply concave, hinge line straight, cardinal extremities rounded. The hinge line is finely crenulated, the crenulations extending over half the distance to the extremities. A cast of the interior shows the well-defined crural process, and the pustulose character of the surface. Exterior marked by numerous, irregular and unequal costae which are crossed by coarser concentric lines of growth.

Pedicle valve unknown.

Remarks—Impressions of the exterior of the brachial valve, and casts of the interior of the same valve have been observed. The species seems to be distinct from *Brachyprion schuchertanum* Clarke in that it is proportionately smaller and longer.

Horizon—Lower beds.

Figured specimens No. 27471 Walker Museum.

Genus *Schuchertella* Girty

Schuchertella sp.

Plate 62, figure 11.

Description—Shell of medium size, transversely elliptical, broader than long. The dimensions of a brachial valve are: Length approximately 31 mm., width 48 mm., the hinge line equal to the greatest width of the shell.

Pedicle valve moderately convex, the maximum convexity anterior to the umbonal region. From the middle, the surface the shell slopes toward the cardinal extremities in a manner to form a gently concave area upon each side. Surface marked by fine radiating costae, which increase by interstitial addition, there being about 20 in the space of 1 mm.

Remarks—One incomplete pedicle valve only occurs which is not certainly determinable.

Horizon—Lower beds.

Figured specimen No. 27470 Walker Museum.

Family Productidae

Genus *Anoplia* Hall and Clarke

Anoplia nucleata (Hall)

Plate 63, figure 5.

1857. *Leptaena nucleata* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 47.

1859. *Leptaena nucleata* Hall, Nat. Hist., N. Y. Pal., vol. 3, p. 419, pl. 94, figs. 1a-1d, 1861.

1892. *Anoplia nucleata* Hall and Clarke, *ibidem*, vol. 8, pt. 1, p. 309, pl. 15a, figs. 17, 18; pl. 20, figs. 14-17.

1903. *Anoplia nucleata* Weller, Geol. Surv., N. J. Pal., vol. 3, p. 325, p. 41, fig. 9; p. 349, pl. 46, figs. 8-10.

1908. *Anoplia nucleata* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 211, pl. 41, figs. 15-17.

1913. *Anoplia nucleata* Schuchert, Geol. Surv. Md. Low. Dev., p. 340, pl. 61, figs. 22-24.

A single internal cast of a pedicle valve is the only specimen representative of this common Oriskany brachiopod. The dimensions are: Length 3 mm., width approximately 4 mm. The valve is extremely gibbous and exhibits the characteristic groove in the beak which extends almost to the middle of the shell. Surface features not preserved.

Horizon—Upper beds.

Figured specimen No. 27469 Walker Museum.

Genus *Chonostrophia* Hall and Clarke.

Chonostrophia complanata (Hall)

Plate 63, figures 6-7.

1857. *Chonetes complanata* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 56.
 1859. *Chonetes complanata* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 418, pl. 93, fig. 1, 1861.
 1892. *Chonostrophia complanata* Hall and Clarke, *ibidem*, vol. 8, pt. 1, p. 311, pl. 16, figs. 13-29.
 1900. *Chonostrophia complanata* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 50, pl. 7, figs. 1-13.
 1908. *Chonostrophia complanata* Clarke, N. Y. State Mus., Mem. 9, pt. 1, p. 210, pl. 46, figs. 6-13.
 1913. *Chonostrophia complanata* Schuchert, Geol. Surv., Md. Low. Dev., p. 341, pl. 62, figs. 1-2.

Description—Shell of medium size, broadly semi-circular in outline. The dimensions of an average sized pedicle valve are: Length 20 mm., width 24 mm. Another pedicle valve with a proportionately longer hinge line measures 17 mm. in length and 31 mm. in width. Hinge line equal to the greatest width of the shell; cardinal extremities acute.

Pedicle valve concave to nearly flat, slightly convex in the umbonal region, becoming gently concave toward the margins. Cardinal margin marked with a row of spines inclined towards the extremities on either side of the beak. Latter small, slightly incurved, scarcely elevated above the hinge line, apex pierced by a round foramen. The interior of the valve shows the strongly defined pustulose character of the surface.

On the exterior are fine, radiating, bifurcating costae, which are crossed by indistinct concentric lines of growth. In some cases minute concentric striae are preserved.

Remarks—This species is represented abundantly in the Little Saline beds by the exteriors and interiors of the pedicle valves, but in none of them are the cardinal spines well preserved. The specimens are generally smaller than in the New York Oriskany, resembling in this respect those from the Becraft mountain Oriskany, and those from the Grand Greve limestone, Gaspe, Quebec.

Horizon—Lower and upper beds.

Figured specimens No. 27468 Walker Museum.

Order Telotremata

Superfamily Rhynchonellacea

Family Rhynchonellidae

Genus *Eatonia* Hall

Eatonia peculiaris (Conrad)

Plate 62, figures 12-16.

1841. *Atrypa reticularis* Conrad, Geol. Surv., N. Y. Fifth Ann. Rept., p. 56.
 1859. *Eatonia peculiaris* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 244, pl. 38, figs. 21-26; pl. 101, figs. 2a—g; pl. 101, fig. 2; pl. 101a, fig. 1.

1874. *Eatonia peculiaris* Billings, Pal. Fossils, vol. 1, pt. 2, p. 40, pl. 3a, fig. 2, a-c.
 1894. *Eatonis peculiaris* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 8, pt. 2, pl. 61, figs. 17-26.
 1908. *Eatonia peculiaris* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 172, pl. 29, figs. 1-13.
 1913. *Eatonis peculiaris* Schuchert, Geol. Surv., Md. Low. Dev., p. 372, pl. 65, figs. 23-28.

Description—Shell commonly small, and a little longer than wide, but in some specimens the length and breadth are the same. An average individual measures 17 mm. in length, and 15 mm. in width. The dimensions of the largest specimen observed are: Length 25 mm., width 22 mm. Shell distinctly ovate in outline, the cardinal margins diverge from the beaks and form a flattened oval area on each side of the shell.

Pedicle valve depressed convex posteriorly from the middle of the shell toward the beak, but gently concave toward the margins of the cardinal slopes, where it becomes abruptly inflected. Anteriorly the valve is prolonged into a long linguiform extension.

Brachial valve convex, the surface sloping abruptly to the lateral margins. Toward the anterior margin the middle is elevated into a fold. Margins of both valves serrated, the serrations on the brachial more prominent than those on the opposite valve.

Surface of entire shell covered with fine, bifurcating striae, 5 to 6 of which occupy the space of 1 mm.

Remarks—This form, next to the *Spirifers*, is perhaps the most abundant fossil in the Little Saline beds, and it is the only species which occurs commonly with the two valves in articulation, complete specimens being found in a splendid state of preservation. Many of the shells are larger than those from the Oriskany beds of New York, and resemble rather in size those from the Grand Greve limestone of Gaspe, Canada, exhibiting a similar variation in shape and size.

This species is characterized by the linguiform projection of the anterior margin, the strong inflection of the pedicle valve along the cardinal slopes, and the serrated margins of the valves.

Horizon—Lower and upper beds.

Figured specimens No. 27467 Walker Museum.

Eatonia plicata sp. nov.

Plate 63, figures 1-4.

Description—Shell small, relative length and width variable, although the length is commonly greater than the width. The holotype which is an average-sized individual measures 13 mm. in length and 11 mm. across its greatest width which is slightly anterior to the middle of the shell. The form is elongate oval in outline, with the cardinal margins converging abruptly to the beak. Anterior margin serrated.

Pedicle valve depressed convex in the umbonal region, and flattening out towards the middle into a sinus which is prolonged into a long linguiform extension of the anterior margin. Toward the lateral margin the shell becomes inflected somewhat abruptly. Umbonal region scarcely differentiated; beak small, acute, incurved slightly, the apex pierced by a round foramen.

Brachial valve rather highly convex; near the anterior margin the middle becomes elevated into a fold. Umbonal region arched; the beak larger than in the opposite valve and more rounded.

Surface of both valves marked by simple radiating, coarse, angular plications, from 16 to 18 present on each valve, which are separated by deep narrow interspaces. The

plications increase rapidly in size toward the anterior margin. Near the postero-lateral margins the last two or three become obsolete.

Remarks—The exteriors of the separate valves occur. This species differs from *Eatonia peculiaris* Conrad, in its smaller size, in the presence of coarse angular plications, in the more broadly extended pedicle valve, and in the sharper mesial fold of the brachial valve.

Horizon—Lower beds.

Holotype and Paratypes No. 27466 *Walker Museum*.

Genus *Uncinulus* Bayle

Uncinulus parvus sp. nov.

Plate 63, figures 11-12.

Description—Shell small, sub-pentagonal in outline, length and width nearly equal, the postero-lateral margins meeting at the beak in an angle of 90 degrees or a little less. The dimensions of a perfect specimen, the holotype, are: Length 17 mm., width 17.5 mm., the greatest width midway between the beak and anterior margin. Cardinal extremities rounded.

Pedicle valve moderately convex, the most pronounced convexity in the region of the umbo; depressed anteriorly into a broad ill-defined sinus. Beak small, acute, elevated over the beak of the opposite valve.

Brachial valve a little more convex than the pedicle, elevated anteriorly into a scarcely perceptible mesial fold; beak incurved below that of the other valve.

Surface of each valve marked by about 18 simple, rounded plications, which become obsolete in the umbonal region, 6 of them included in the fold and sinus. Fine concentric striae and irregular lines of growth cross the plications. Lateral and anterior margins of contact sharply serrated.

Remarks—Only one entire specimen of the above species, the holotype, has come under observation, but a separate pedicle valve is doubtfully referred to the same species. The species has been observed only in the upper beds, and is distinct from all the other *Uncinulae* present because of its small size, and the slight development of the fold and sinus. For these reasons one cannot be reasonably sure that it is a mature individual. The form resembles somewhat closely the figured specimen of *Uncinulus convexorus*¹ Maynard, fig. 14, but is entirely dissimilar to figs. 9-13 of the same species on which presumably the description is based.

Horizon—Upper beds.

Holotype No. 27463 *Walker Museum*.

¹Maynard, T. P., Geol. Surv., Md. Low Der., pl. 65, figs. 9-14.

Uncinulus salinesis sp. nov.

Plate 63, figures 8-10

Description—Shell of medium size, sub-pentagonal in outline; width slightly greater than the length. The dimensions of the holotype are: Length 32 mm., width 35 mm., the maximum width anterior to the middle of the shell. The lateral margins conspicuously flattened and sharply serrated. The postero-lateral margins slope abruptly to the beaks, and are gently concave forming oval areas.

Pedicle valve depressed convex in the umbonal region, gradually flattening out to form a broad shallow sinus at the anterior margin, which projects in a linguiform extension, fitting into the mesial fold of the opposite valve. The surface slopes gradually to the lateral margins, where it turns abruptly forming a sharp angle, and meeting the brachial valve at right angles. Beak triangular, with acute apex, and apparently a

little elevated above the opposite. A cast of the interior shows a broad shallow depression extending half way to the anterior margin.

Brachial valve larger than the pedicle, and strongly convex to gibbous. Near the anterior margin it is elevated into a broad, sharply defined fold. At the lateral margins the shell becomes abruptly inflected, forming a flat area corresponding to a similar one on the other valve.

Surface of each valve marked with about 40 angular plications, the last two or three near the hinge becoming almost obsolete. Ten of the plications occupy the sinus. Indistinct concentric lines of growth are present.

Remarks—Two specimens referable to this species have been observed, one a nearly complete individual, the other a cast of the interior of the pedicle valve.

Horizon—Lower beds.

Holotype and Allotype No. 27464 *Walker Museum*.

Uncinulus welleri sp. nov.

Plate 63, figures 13-14.

Description—Shell of medium size, elongate oval, sub-pentagonal in outline. The dimensions of the holotype are: Length 30 mm., width 27 mm. Some specimens are larger; as much as 35 mm. in length, and 30 mm. in width. Shell characterized by flat and serrated lateral margins, and by gently concave postero-lateral margins which slope steeply to the beak.

Pedicle valve arched in the umbonal region, becoming strictly concave toward the anterior margin and forming a broad shallow sinus which becomes extended into a linguiform projection. Lateral margins inflected, forming flat lateral areas. Beak small, and incurved closely over that of the opposite valve.

Brachial valve highly convex, the anterior margin elevated into a scarcely perceptible fold. Toward the lateral margins the shell surface slopes abruptly, forming continuous flat areas with those produced by the inflection of the opposite valve. Beak sharply pointed, incurved below the other.

Surface of both valves marked with 40 to 50 simple angular plications, which are separated by deep, narrow furrows. Seven plications occupy the sinus.

Remarks—Only a few examples of this species have been observed. It may be distinguished from *Uncinulus salinensis* by its more elongate form, and by the less prominent fold and sinus. The species resembles *Uncinulus nobilis* Hall from the Helderbergian of New York, and may be a later development of that form, but it differs in being larger, in having a greater number of plications, and a flatter and less sharply marked mesial sinus.

Horizon—Lower beds.

Holotype and Paratype No. 27465 *Walker Museum*.

Name—This fossil has been named after Professor Stuart Weller, of the Department of Paleontology, University of Chicago.

Genus *Plethorhyncha* Hall and Clarke

Plethorhyncha barrandii (Hall)

Plate 63, figures 15-16.

- 1857. *Rhynchonella barrandii* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 82, figs. 1-3; pl. 84, fig. 4.
- 1908. *Plethorhyncha barrandii* Clarke, Mem. M. Y. State Mus., vol. 9, pt. 1, p. 171, pl. 28, figs. 16-17.
- 1913. *Camarotoechia* (*Plethorhyncha*) *barrandii* Schuchert, Geol. Surv., Md. Low. Dev., p. 359, pl. 64, figs. 2-3.

Description—Shell large, sub-oval in outline, strongly convex, length usually greater than the width. A medium sized brachial valve measured 53 mm. in length and 40, mm. in width. The dimensions of the pedicle valve of another individual are: Length 45 mm., width 36 mm., the greatest width anterior to the middle of the shell. The lateral margins of both valves are conspicuously flattened.

Pedicle valve depressed convex, the greatest convexity just below the umbonal region. Near the anterior margin a broad shallow sinus is developed. Whether this is extended into a linguiform projection as described by Hall cannot be ascertained from the imperfect material at hand. The sides of the sinus curve upwards forming sharp lateral margins, the sides of which slope abruptly to meet the opposite valve. Beak pointed and only slightly incurved.

Brachial valve convex to gibbous. The shell surface slopes uniformly from the middle towards the lateral margins, then turns abruptly, meeting the other valve at right angles. Beak incurved more than that of the pedicle valve.

Surface of each valve marked with about 40 radiating, angular plications, and several indistinct ones near the postero-lateral margins. Intervening spaces narrow.

Remarks—A limited number of separate valves have come under observation. They are distinguished from the other species of *Plethorhyncha* with which they are associated by their larger size, and their coarser plications. With the exception of one fragment none of the specimens attain the proportions of the larger New York specimens.

Horizon—Lower beds.

Figured specimens No. 27461 *Walker Museum*.

Plethorhyncha principalis (Hall)

Plate 64, figures 1-3.

1856. *Rhynchonella principalis* Hall, Regents Rept., p. 84, Paleozoic Fossils, 1857, p. 44.

1859. *Rhynchonella principalis* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 443, pl. 106, fig. 4.

Description—Shell large, elongate oval, relative length and width variable. The dimensions of an average sized pedicle valve are: Length 45 mm., width 38 mm., the greatest width anterior to the middle of the shell.

Pedicle valve depressed convex, arched in the umbonal region, in some specimens forming a broad median ridge, the surface gradually flattening out toward the anterior margin to form a broad, shallow sinus. The shell surface slopes uniformly from the middle and forms sharp, lateral margins as it becomes abruptly inflected to produce flat, lateral areas. Beak flat, acute, slightly incurved.

Brachial valve convex to gibbous, flattening somewhat towards the anterior margin. Lateral margins abruptly incurved to meet the opposite valve at right angles. Beak arched and incurved more strongly than the beak of the pedicle valve.

Surface of each valve marked with from 60 to 80 radiating plications, which are exceedingly fine near the beak. These are crossed by faint, concentric growth lines.

Remarks—This species occurs abundantly in the Little Saline limestone, and is commonly represented by somewhat fragmental separate valves. This species is closely allied to *Plethorhyncha barrandii* Hall, and in many cases it is almost impossible to draw a line of demarcation between the two species, one grading imperceptibly into the other. In general, however, this species may be distinguished by its smaller size, by the finer plications, and by the proportionately broader brachial valve.

Horizon—Lower and upper beds.

Figured specimens No. 27460 *Walker Museum*.

Superfamily Terebratulacea

Family Centronellidae

Genus *Centronella* Billings*Centronella glansfagea* (Hall)

Plate 64, figures 4-7.

1857. *Rhynchonella glansfagea* Hall, N. Y. State Cab. Nat. Hist., Tenth Ann. Rpt., p. 125, figs. 1-6.
 1867. *Centronella glansfagea* Hall, Nat. Hist. N. Y. Pal., vol. 4, p. 399, pl. 61a, figs. 1-21, 25-26.
 1908. *Centronella glansfagea* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 163, pl. 25, figs. 1-4.

Description—Size of shell variable, small to medium, sub-quadrate or spoon-shaped, the cardinal margins sloping abruptly to the beaks; length greater than the width, the maximum width about midway between the beak and anterior margin. The dimensions of two different individuals are: Length 20 mm., width 14 mm. and length 14 mm., width 10 mm.

Pedicle valve larger than the brachial, convex, usually sub-carinate along the middle, the surface sloping steeply to the lateral margins. Beak considerably elevated above that of the opposite valve, abruptly curved, and extended in a horizontal plane so that the apex lies well beyond the brachial valve.

Brachial valve smaller than the pedicle, depressed convex, towards the anterior margin becoming flatter and forming a faintly defined mesial sinus which includes the entire width of the shell. A small extremely carinated specimen shows a well defined sinus extending from beak to anterior margin. Beak small, incurved below the opposite.

Surface smooth, shell substance very finely punctate. The concentric lines of growth are especially prominent on the brachial valve.

Remarks—The few specimens studied seem to be fairly constant in their characters, and show no marked deviation from the New York examples.

Horizon—Upper beds.

Figured specimens No. 27507 Walker Museum.

Genus *Rensselaria* Hall*Rensselaria ovoides* (Eaton)

Plate 64, figures 8-12.

1832. *Terebratula ovoides* Eaton, Geological Textbook, p. 45.
 1859. *Rensselaria ovoides* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 456, pl. 104, figs. 1-4; pl. 105, figs. 1-6.
 1900. *Rensselaria ovoides* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 39, pl. 5, figs. 17-19.

Description—Shells varying in size from medium to large, but in no case do they attain the large proportions of the New York examples. Some specimens are extremely gibbous, others less so. Both valves are incurved toward the lateral margins, and produce a conspicuous flattening of the shell. There is a distinct variation from elongate-oval or spatula-shaped gibbous forms to shorter and less gibbous ones. An average mature specimen is considerably longer than broad and measures about 62 mm. in length, and 40 mm. across its greatest width which is well above the middle of the shell. The dimensions of a smaller individual, and this size seems to be abundant, are: Length 35 mm., width 20 mm.

Pedicle valve commonly strongly convex transversely, the greatest convexity in the region of the greatest width. Shell surface sloping uniformly from the middle towards the lateral margins to near the edge where it becomes abruptly inflected, and bends almost at right angles toward the other valve. Beak fairly high, closely incurved over the umbo of the opposite valve.

Brachial valve less convex than the pedicle, the surface sloping more gently to the lateral margins, but near the edge being deflected in a similar manner. Beak less elevated than the beak of the pedicle valve.

Surface of both valves marked by fine, radiating costae, 3 occupying the space of 1 mm. These are crossed by conspicuous concentric growth lines, which show clearly the outline of the shell at various ages.

Remarks—This species which occurs abundantly in the Little Saline limestone, is represented by both entire specimens and by the separate valves. Due to the condition of preservation the punctate shell structure so characteristic of this genus has not been observed in any of the specimens studied. The species is distinguished by the distinct spatula-shaped shell, the high convexity of both valves particularly the pedicle, and the flattened character of the lateral margins in mature individuals.

Horizon—Lower and upper beds.

Figured specimens No. 27506, Walker Museum.

Rensselaeria cf. stewarti Clarke

Plate 64, figures 13-15

1907. *Rensselaeria stewarti* Clarke, Mem. N. Y. State Mus. No. 107, p. 239.

1908. *Rensselaeria stewarti* Clarke, Mem. N. Y. State Mus. No. 9, pt. 2, p. 38, pl. 7, figs. 10-20.

Description—Shell of medium size, usually broader than long, semi-circular in outline. An average individual measures 29 mm. in length and 31 mm. in width. Hinge line equal to the greatest width. Cardinal margins sloping abruptly from the beaks, and terminating in rounded extremities.

Pedicle valve convex, the maximum convexity in the umbonal region, from which the surface slopes uniformly, gradually flattening out toward the anterior and lateral margins. Beak high, triangular, incurved over the hinge line.

Surface marked with simple radiating plications, these gradually diminish in size toward the posterior margin until well above the middle of the shell they become obscure and apparently disappear. In some specimens the plications persist throughout the whole length of the shell. In general one plication occupies the space of 1 mm., at the anterior margin. Posterior to the middle, there are two and sometimes even three in 1 mm. The plications are crossed by coarser, concentric growth lines.

Remarks—This species is represented by the exteriors of the pedicle valve. It resembles *Rensselaeria stewarti* Clarke, from the Dalhousie beds of New Brunswick, Canada, but has a less convex pedicle valve, and a less prominent umbonal region. The species also resembles *Rensselaeria atlantica* Clarke, which occurs in the Chapman sandstone immediately above the Dalhousie beds and it may prove to be more closely allied to this form than to the former. Since many of the Little Saline species are identified with forms in the Grand Greve limestone which is a higher horizon than the Chapman, it would seem plausible that the present form may agree more closely with the form in the higher horizon.

Horizon—Lower and upper beds.

Figured specimens No. 27505, Walker Museum.

Genus *Beachia* Hall and Clarke*Beachia suessana* (Hall)

Plate 64, figures 16, 17

1857. *Meganteris suessana* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 100.
 1859. *Rensselaeria suessana* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 459, pl. 107, figs. 1-15, 1861.
 1913. *Rensselaeria (Beachia) suessana* Schuchert, Geol. Surv., Md. Low. Dev., p. 387, pl. 67, figs. 7-15.

Description—Shell of medium size, a little longer than wide, elongate oval in outline, both shape and size being somewhat variable. The dimensions of an average sized individual are: Length 27 mm., width 25 mm., the greatest width well below the hinge line. Posterior margins sloping somewhat abruptly from the beaks, and terminating in rounded cardinal extremities. Lateral margins of both valves abruptly inflected.

Pedicle valve moderately convex, the greater convexity across the middle of the shell. From the median line the shell slopes uniformly to the margins. Beak small, angular, and well elevated above the opposite valve; apex pierced by a round foramen.

Brachial valve about equally convex with the pedicle, the beak small, inconspicuous, and incurved slightly.

The radiating markings which characterize *Beachia suessana* Hall, from the New York Oriskany seem to be almost always absent in the specimens studied, probably due to the condition of preservation, but a few obscure ones have been noticed. Concentric growth lines mark the shells, these being most prominent near the anterior margin. Punctuate shell structure poorly preserved.

Remarks—Entire specimens and the separate valves occur. These correspond closely to *Beachia suessana* Hall, but differ in having more distinctly rounded anterior margins. There is also a close resemblance to *Beachia amplexa* Clarke, from the Grand Greve limestone of the Gaspé region, but all the specimens which have come under observation are considerably smaller than the former.

This species is characterized by the inflected lateral margins, and the depressed convex valves.

Horizon—Lower beds.

Figured specimens No. 27504, Walker Museum.

Beachia ovalis (Hall)

Plate 65, figure 1

1857. *Meganteris ovalis* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 101.
 1859. *Rensselaeria ovalis* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 458, pl. 106, figs. 2a-1, 1861.
 1913. *Rensselaeria (Beachia) ovalis* Schuchert, Geol. Surv., Md. Low. Dev., p. 389, pl. 67, figs. 17-19.

Description—Shell longitudinally ovate, with a well-rounded anterior margin. The dimensions of an nearly perfect specimen are: Length 42 mm., width 36 mm., the greatest width anterior to the middle of the shell. Lateral margins of both valves strongly inflected.

Pedicle valve depressed convex, the most prominent depression along the middle. Beak well elevated above the hinge line and over the beak of the opposite valve.

Brachial valve about equally convex with the pedicle, but less prominent along the middle. Beak lower than that of the opposite valve and incurved below it.

The simple, radiating costae, which are characteristic of the New York specimens have not been observed. Due to the absence of the original shell surface and the punctate shell structure has also been destroyed:

Remarks—Only one imperfect specimen occurs in the collection. In contrast with the New York specimens it has a more broadly extended anterior margin, and more acute cardinal angles.

Horizon—Lower beds.

Figured specimen No. 27503, Walker Museum.

Superfamily Spiriferacea

Family Atrypidae

Genus *Atrypa* Dalman

Atrypa reticularis (Linne)

Plate 65, figure 2

1767. *Anomia reticularis* Linne, Systema Naturae, ed. 12, tome i, p. 1132.
 1852. *Atrypa reticularis* Hall, Nat. Hist. N. Y. Pal., vol. 2, p. 72, pl. 23, fig. 8; pl. 270, pl. 55, fig. 5.
 1913. *Atrypa reticularis* Maynard, Geol. Surv., Md. Low. Dev., p. 393, pl. 67, figs. 26-28.

This very common Silurian and Devonian brachiopod has not been found in the lower beds of the Little Saline limestone. It is represented in the upper beds by a few imperfectly preserved brachial valves. The dimensions of the largest valve observed are: Length 30 mm., width 29 mm. Other examples are considerably smaller. The valves are moderately convex, and the surface is marked by radiating costae which increase by intercalation. These are crossed by concentric lamellae, usually indistinctly preserved, and giving the characteristic reticulated or decussated appearance. The characters of the few specimens observed seem to be fairly constant.

Horizon—Upper beds.

Figured specimen No. 27502, Walker Museum.

Family Spiriferidae

Genus *Spirifer* Sowerby

Spirifer arenosus (Conrad)

Plate 65, figures 6-8

1839. *Delthyris arenosus* Conrad, Third Ann. Rept. N. Y. Geol. Surv., p. 65.
 1859. *Spirifer arenosus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 425, pl. 98, figs. 1-8; pl. 99, figs. 1-10; pl. c, figs. 1-8.
 1908. *Spirifer arenosus* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 179, pl. 33, figs. 1-10.
 1913. *Spirifer arenosus* Schuchert, Geol. Surv., Md. Low. Dev., p. 415, pl. 71, figs. 1-9; pl. 72, fig. 1.

Description—Shell attaining large size, usually broader than long. The dimensions of an average individual are: Length 50 mm., width 60 mm. Umbonal region wide, beak considerably elevated above the hinge line; in the younger forms this elevation is not so conspicuous. The cardinal extremities in the older individuals commonly well rounded.

Pedicle valve convex, with a wide shallow mesial sinus, which is almost obsolete, in some specimens being little more than a flattening of the surface along that part of the shell. At the apex it includes a single plication, which dichotomizes, until at the anterior margin it is occupied by 5 or 6 plications.

Brachial valve about equally convex with the pedicle. It is characterized by a mesial fold, which presents a more prominent feature than the sinus. The fold starts as a

single plication near the apex, which dichotomizes until at the margin it is represented by 5 or 6 plications.

Surface on each side of the fold and sinus marked by 15 to 20 broad, flattened, simple ribs, separated by flat interspaces. The ribs decrease in size as the cardinal margins are approached.

Remarks—This common Oriskany species occurs abundantly in the Little Saline limestone. The plicated fold and sinus are a distinguishing characteristic of the species. The shells do not display so great variability as does the associated *Spirifer murchisoni* and there seems to be no important differences from the New York examples.

Horizon—Lower and upper beds.

Figured specimens No. 27501, Walker Museum.

Spirifer murchisoni Castelnau

Plate 65, figures 9-11

1843. *Spirifer murchisoni* Castelnau, Essai Syst. Sil. l'Amer. Septent., p. 41, pl. 12, figs. 1-2.
 1859. *Spirifer arrectus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 422, pl. 97, figs. 1a-1h, 2a-ai, pl. 430, 1861.
 1908. *Spirifer murchisoni* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, pl. 177, pl. 32, figs. 1-10.
 1913. *Spirifer murchisoni* Schuchert, Geol. Surv., Md. Low. Dev., p. 411, pl. 70, figs. 1-5.

Description—Shell of medium size or larger, width greater than length, the greatest width along the hinge line. The most common type is a rather broadly extended shell, with regular curving sides. The dimensions of a complete individual are: length 25 mm., width 45 mm.

Pedicle valve convex, characterized by a fairly wide, shallow, mesial sinus, which flattens out toward the anterior margin.

Brachial valve equally convex with the pedicle, the middle portion elevated into an acute fold; beak incurved beyond the hinge line.

Eight or nine strong, regularly rounded plications, with two or three indistinct ones near the cardinal angles are present on each lateral slope of the valves. The intervening grooves are also rounded. Surface ornamented by fine, closely arranged, radiating striae, which are crossed by concentric striae.

Remarks—The separate valves usually occur, entire individuals are uncommon. The shells exhibit considerable variation in the size, width and depth of sinus, height of fold, angularity and strength of plications, but these differences do not seem to be constant enough to warrant a division into separate species. In general the Little Saline specimens correspond with the same species occurring in the Grand Greve limestone of the Gaspe region.

Horizon—Lower and upper beds.

Figured specimens No. 27500, Walker Museum.

Spirifer cf. varicosa Hall

Plate 65, figure 12

1857. *Spirifer varicosa* Hall, Tenth Rept. on the State Cab., p. 130.
 1867. *Spirifer varicosa* Hall, Nat. Hist. N. Y. Pal., vol. 4, p. 205, pl. 31, figs. 1-4.

Description—Two fragmentary brachial valves have been observed which may be compared with this Onondagan species. The strongly elevated mesial fold with flattened summit, and the characteristic surface markings constitute the distinguishing marks of the species.

Horizon—Upper beds.

Figured specimens No. 27499, Walker Museum.

Genus *Metaplasia* Hall and Clarke*cf. Metaplasia pyxidata* Hall

Plate 65, figure 14

1859. *Spirifer pyxidata* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 428, pl. 100, figs. 9-12, 1861.
 1913. *Metaplasia pyxidata* Schuchert, Geol. Surv., Md. Low. Dev., p. 422, pl. 72, figs. 11-12.

Description—Shell small, length less than the width, the hinge line equal to the greatest width of the shell; sub-elliptical in outline. The dimensions of a pedicle valve are: Length 6 mm., width approximately 7 mm.

Pedicle valve highly convex, elevated along the middle line into a pronounced median fold with narrow sinus along the summit. Beak prominent, blunt and incurved. Surface essentially smooth.

Remarks—The pedicle valve of a small brachiopod resembles this species somewhat closely, but since there is nothing present in the collection to represent the brachial valve, and since the specimen is incomplete no certain identification can be made. This specimen studied differs from the figured specimens from New York and Maryland. (1) in being considerably smaller, (2) in having a more prominent beak, (3) in having steeply sloping postero-lateral margins, and (4) in having a total absence of surface striations.

Horizon—Upper beds.

Figured specimen No. 27498, Walker Museum.

Family Suessidae

Genus *Cyrtina* Davidson*Cyrtina rostrata* Hall

Plate 65, figure 13

1857. *Cyrtia rostrata* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 64.
 1859. *Cyrtia rostrata* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 429, pl. 96, figs. 1-6; pl. 98, figs. 8a-8b, 1861
 1908. *Cyrtina rostrata* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 183, pl. 31, figs. 25-28.
 1913. *Cyrtina rostrata* Schuchert, Geol. Surv., Md. Low. Dev., p. 423, pl. 71, figs. 10-16.

Description—The only example at hand is an incomplete brachial valve which undoubtedly belongs to this species. Shell small, semi-circular in outline. The dimensions are: Length 10 mm., width approximately 17 mm., the hinge line being equal to the greatest width of the shell. Shell almost flat, or depressed convex, with a conspicuously marked, slightly flattened mesial fold, which increases in width from the beak to the anterior margin. Beak small and incurved a little over the hinge line. The surface on each side of the fold is marked with 6 or 8 radiating plications, which are crossed by finer, concentric, sharply zigzag lines.

Remarks—Sufficient portion of the brachial valve is present to demonstrate the outstanding features of this species—the semi-circular outline of the shell, the long, straight hinge line, and the coarse, radiating plications.

Horizon—Lower beds.

Figured specimen No. 27495, Walker Museum.

Family Rhynchospiridae

Genus Rhynchospira Hall

Rhynchospira attenuata sp. nov.

Plate 65, figure 3

Description—The collection contains a single nearly complete pedicle valve of a Rhynchospira, which belongs to an undescribed species. Shell of medium size, longitudinally subovate, postero-lateral margins converging gradually to the beak. The dimensions are: Length 14 mm., width 11 mm. Beak elongate, acute, apex perforated by a round foramen.

Surface marked by 10 to 12 simple, coarse, angular plications.

Brachial valve unknown.

Remarks—This form is unlike any described species of the genus in the extremely elongate and attenuate beak, and the more coarsely plicate surface.

Horizon—Upper beds.

Holotype No. 27497, Walker Museum.

Trematospira multistriata (Hall)

Plate 65, figures 4, 5

1857. *Spirifer multistriata* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 59, figs. 1-6.

1859. *Trematospira multistriata* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 209, pl. 24, figs. 3a-3f; pl. 28a, figs. 5a-5f.

1900. *Trematospira multistriata* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 43, pl. 6, figs. 1-4.

1913. *Trematospira multistriata* Schuchert, Geol. Surv., Md. Low. Dev., p. 428, pl. 73, figs. 3, 4.

Description—Shell of medium size, transversely oval in outline, cardinal extremities rounded. The dimensions of two separate valves are: Pedicle, length 19 mm., width 25 mm.; brachial, length 18 mm., width approximately 22 mm., the greatest width a little in front of the hinge line.

Pedicle valve moderately convex, with an ill-defined mesial sinus, which is broad and shallow at the anterior margin, but towards the beak becomes narrow and almost obsolete. Beak small, blunt, incurved over that of the opposite valve; apex pierced by a round foramen.

Brachial valve slightly more convex than the pedicle, the middle portion elevated into a scarcely perceptible fold which broadens anteriorly. Beak small, closely incurved below the other.

Surface of both valves marked by numerous prominent, angular, radiating plications; these bifurcate at regular intervals, each one usually twice in passing from the beak to the anterior margin, hence giving the surface a fasciculate appearance. Concentric lines of growth across the shell.

Remarks—This characteristic Helderbergian form is represented in the Little Saline fauna by a few separate valves but among the specimens studied none attain the large size of the full-grown New York examples as figured by Hall. In size, and in the number and coarseness of the plications, they seem to be more closely allied with the southern examples figured in the Maryland reports.

Horizon—Upper beds.

Figured specimens No. 27496, Walker Museum.

Family Meristellidae

Genus *Nucleospira* Hall*Nucleospira cf. ventricosa* (Hall)

Plate 66, figures 1-3

1857. *Spirifer ventricosa* Hall, Tenth Ann. Rept. N. Y. State Cab. Nat. Hist., p. 57.
 1859. *Nucleospira ventricosa* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 220, pl. 14, fig. 1; pl. 28b, figs. 2-9, 14, 1861.
 1913. *Nucleospira ventricosa* Schuchert, Geol. Surv., Md. Low. Dev., p. 430, pl. 73, figs. 10-12.

Description—Shell small, transversely oval in outline. The dimensions of an imperfect brachial valve are: Length approximately 9 mm., width 11 mm. A smaller brachial valve measures 6 mm. in length and 8 mm. in width. The cardinal margins slope abruptly from the beaks, and terminate in well rounded extremities.

Brachial valve convex, median portion most elevated, and marked with a shallow sinus extending from the beak to the anterior margin. Beak pointed, moderately elevated. Surface marked by indistinct concentric growth lines.

Concerning the pedicle valve Hall says: "Ventral valve having a narrow sinus extending down the centre from beak to base; beak projecting above the other, strongly incurved and pointed (in many specimens the beaks are nearly equal)"—Hall, 1859.

Remarks—Three or four fragmentary brachial valves have been observed in the collection, which resemble *Nucleospira ventricosa* Hall, from the New Scotland beds of New York, and they are undoubtedly a later expression of that species. Except that the specimens observed possess more steeply sloping cardinal margins there seems to be no important variation from this New Scotland species.

Horizon—Lower beds.

Figured specimens No. 27494, Walker Museum.

Genus *Meristella* Hall*Meristella ampla* sp. nov.

Plate 66, figures 9-11

Description—Shell from medium size to large, sub-quadrate in outline, relative length and width variable, but generally the width slightly greater than the length. The dimensions of the holotype, which is an average sized brachial valve are: length 36 mm., width 37 mm. Cardinal margins slope steeply to the beaks, extremities rounded.

Pedicle valve moderately convex, the greatest convexity in the umbonal region, apparently flattened anteriorly. Beak broad and flat, incurved slightly. A cast of the interior shows a large, strongly defined muscular area which is longitudinally striate. A long narrow process projects from the muscular platform to the beak. The region surrounding the muscular area is rugose.

Brachial valve more convex than the opposite, maximum convexity in the umbonal region, and a flattening occurs anteriorly similar to that of the opposite valve. Beak incurved slightly.

Surface of both valves essentially smooth with faint lines of growth.

Remarks—This form is represented by the separate valves only. It resembles *Meristella sub-quadrate* Hall, but has a less distinctly quadrate outline, the pedicle valve is less convex, and the anterior margin more broadly rounded. It differs from associated species in the larger size of the full-grown examples, and in the greater tendency to quadrate outline.

Horizon—Lower beds.

Holotype and Paratypes No. 27487, Walker Museum.

Meristella carinata sp. nov.

Plate 66, figures 12-21

Description—Shell of medium size, sub-quadrate in outline, relative length and width variable, sometimes equal. The dimensions of a perfect individual, the holotype, are: Length 23 mm., width 24 mm. Hinge line less than the greatest width of the shell. Cardinal margins gently concave, forming depressed oval areas on both sides of the beak; extremities rounded.

Pedicle valve sub-quadrate in outline, arched from beak to base, depressed convex to about the middle, and then becoming somewhat concave to form a broad, shallow sinus, which at the anterior margin is projected into an acute linguiform extension. Beak elevated, rounded, and closely incurved over the brachial beak. An impression of the interior shows the large and strongly defined, fan-shaped muscular impressions.

Brachial valve strongly convex to gibbous, the median portion elevated into a sharply sub-carinated or rounded fold, which in some specimens is especially well defined at the anterior margin. From the fold the sides slope steeply to the lateral margins. Beak incurved below that of the opposite valve. The interior shows the impression of a narrow median septum extending over half way to the base.

Surface of both valves marked by concentric lines of growth, which are paralleled by numerous finer striations.

Remarks—This is a common species in the collection, and is represented by entire specimens and by individual valves. It approaches *Meristella lata* Hall, of the New York Oriskany, but differs in its smaller size, in the more sharply defined median portion of the brachial valve, in the more depressed pedicle valve, and in the projection of the sinus into linguiform extension. This form is especially characterized by the carinated brachial valve, and this feature distinguishes it from associated species.

Horizon—Lower beds.

Holotype and Paratypes No. 27492, Walker Museum.

Meristella elliptica sp. nov.

Plate 66, figures 4, 5

Description—Shell of medium size, elongate elliptical in outline, length considerably greater than the width. The dimensions of two perfect pedicle valves are: Length 28 mm., width 22 mm., and length 23 mm., width 19 mm., the maximum width midway between the beak and anterior margin.

Pedicle valve moderately convex, no indication of sinus, but a slight flattening of the shell is visible toward the rounded anterior margin. Beak prominent, incurved, apparently acute. Surface marked by fine concentric growth lines which are especially prominent near the base.

Brachial valve unknown.

Remarks—The species approaches *Meristella laevis* Hall, but differs in its more elongate form, and in the absence of a sinus.

Horizon—Lower beds.

Holotype and Paratypes No. 27490, Walker Museum.

Meristella ovalis sp. nov.

Plate 66, figures 6-8

Description—Shell of medium size, transversely oval in outline, usually broader than long. The dimensions of two separate valves are: Length 21 mm., width 25 mm., and length 14 mm., width 16 mm., the maximum width midway between the beak and anterior margin, or slightly anterior to the middle.

Brachial valve moderately convex, the greatest convexity in the umbonal region. Surface of the shell sloping uniformly to the lateral and broadly rounded anterior margins. Beak broad and incurved a little. Surface smooth except for the fine lines of growth which become more prominent near the base of the shell.

Pedicle valve unknown.

Remarks—The species of *Meristella* present a somewhat perplexing problem because the variation within each species is so great, and the gradation from one to another is so complete that a separation of the forms is difficult. The difficulty of separating the species is increased because so few entire specimens occur, the separate valves being most common, and no pedicle valve can at present be linked with the brachial valve here described with any degree of certainty.

These brachial valves bear a marked resemblance to those of *Meristella bella* Hall, but differ in being less gibbous, and in the absence of a mesial sinus which is a feature of that species, and which causes an emarginate outline of the front, not noticeable here.

Horizon—Lower beds.

Holotype and Paratypes No. 27489, Walker Museum.

Family Coelospiridae

Genus *Anoplothea* Sandb.

Anoplothea dichotoma (Hall)

Plate 66, figures 22-25

1859. *Leptocoelia dichotoma* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 452, pl. 103, b, figs. 3a-3c.

1913. *Anoplothea dichotoma* Schuchert, Geol. Surv., Md. Low. Dev., p. 435, pl. 73, figs. 24-26.

Description—Shell small, concavo-convex, generally ovate. The dimensions of a somewhat imperfect pedicle valve are: Length 8 mm., width approximately 9 mm. The brachial valve of a different individual measures 7 mm. in length and 8 mm. in width.

Pedicle valve strongly convex, the middle elevated into a fold, from which the surface slopes abruptly to the lateral margins, and less steeply to the anterior margin. Greatest elevation in the umbonal region. Beak elevated above the hinge line, and notably incurved.

Brachial valve flattened at the postero-lateral margins, and near the beak depressed into a narrow sinus which becomes broad and shallow near the base of the shell.

Surface of both shells marked by radiating plications, which are imperfectly preserved. According to Hall "The surface is marked by dichotomizing plications, the central one of the dorsal valve becoming tripartite, and the three lateral, which are simple to their original, bifurcating and making 6 at the margin of the shell. On the central valve there are two smaller plications in the centre, and a dichotomizing one on each side; concentrically marked by a few imbricating lines of growth."—Hall, 1859.

Remarks—About half a dozen separate valves have been observed. They are smaller than the New York forms, and show the surface characters only indistinctly. The ovate outline, the highly convex to sub-carinate pedicle valve, and the plano-convex brachial valve with broad shallow sinus, are distinct features of the species which the specimens exhibit.

Horizon—Lower beds.

Figured specimens No. 27484, Walker Museum.

Anoplothea flabellites (Conrad)

Plate 66, figures 26, 27

1841. *Atrypa flabellites* Conrad, Fifth Ann. Rept. N. Y. Geol. Surv., p. 55.

1859. *Leptocoelia flabellites* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 449, pl. 106, figs. 1a-1f; pl. 103b, figs. 1a-1f, 1861.

1913. *Anoplothea (Leptocoelia) flabellites* Schuchert, Geol. Surv., Md. Low. Dev., p. 438, pl. 73, figs. 29-33.

Description—Shell of medium size, usually broader than long, from sub-oval to semi-circular in outline. The pedicle valve of an average sized individual measures 11 mm. from beak to anterior margin, and 13 mm. along the hinge line which is equal to the greatest width.

Pedicle valve convex, the maximum convexity along the middle. Beak slightly incurved above the hinge line, perforation in apex not observed. Cardinal extremities rounded. Surface marked with ten coarse, angular plications, the middle plication somewhat smaller than the two adjacent ones.

"Dorsal valve flat; beak straight; hinge line sloping from the beak at an angle of 110 to 160 degrees, rounded at the extremities. On the dorsal valve the two middle plications are a little closer together, and slightly more prominent near the front than the others; while the depressions separating them from these, each side, are a little wider and deeper than those between the other plications."—Hall, 1859.

Remarks—This characteristic lower Devonian species is represented in the Little Saline limestone by very few examples. There is a slight individual variation in the shape, the degree of slope of the cardinal margins, and the amount of rounding of the cardinal extremities, but on the whole the characters seem to be fairly constant. The specimens observed are smaller than those of this species figured from the Grand Greve limestone, and compare more closely in size with those from the Moose River sandstone, New Brunswick.

Horizon—Lower beds.

Figured specimens No. 27486, Walker Museum.

MOLLUSCA

Class PELECYPODA

Order Prionodesmacea

Superfamily Pteriacea

Family Pteriidae

Genus *Actinopteria* Hall

Actinopteria insignis Clarke

Plate 67, figures 1, 2

1900. *Actinopteria insignis* Clarke, Mem. N. Y. State. Mus., vol. 3, No. 3, pl. 35, pl. 4, figs. 10-13.

Description—Clarke discusses this species as follows: "In form and proportions this shell resembles a young *Actinopteria communis*, but its habit is always small, and its exterior profoundly cancellated. It is oblique, with large and much depressed posterior wing, and small but nasute anterior wing, separated from the body of the shell by a broad sulcus distinctly extending to the umbo. The principal radial striae are strong and rounded, each interspace bearing from one to three very much smaller ones, making a more marked contrast in the size of the radii than is exhibited by the species *Actinopteria communis*. These lines are crossed by close concentric lamellae cancellating the entire surface, though both series of lines are quite obscure on the posterior wing. To a certain degree this shell presents in miniature the characters of the species *Actinopteria textilis*, which is mainly distinguished from its associate, *Actinopteria communis*, in the stronger cancellation and interruption of the radii."—Clarke, 1900.

Remarks—A single well-preserved small specimen referable to this species has been observed and a larger one is doubtfully referred to the same species.

Horizon—Lower beds.

Figured specimens No. 27555, Walker Museum.

Actinopteria?

Plate 67, figures 3, 4

The Little Saline limestone affords a few fragmentary examples which are tentatively referred to this genus. The pelecypods in general are represented by mere fragments, and constitute a subordinate part of the fauna.

Horizon—Lower beds.

Figured specimens Nos. 27556, 27557, *Walker Museum*.

Family Pectinidae

Genus *Aviculopecten* M'Coy

Aviculopecten sp. undet.

Plate 67, figure 5

A fragment of an *Aviculopecten* has been observed which is unsuitable for certain determination. The surface is characterized by the presence of coarse distinct ribs, with each intervening space divided by a lower less prominent rib, and the interspaces marked by fine, indistinct striae. Concentric, undulating markings cancellate the ribs; these are uniformly spaced at a distance of from 1.5 to 2 mm. apart.

Horizon—Lower beds.

Figured specimen No. 27558, *Walker Museum*.

Class GASTROPODA

Subclass Streptoneura

Order Aspidobranchia

Suborder Rhipidoglossa

Family Trochonematidae

Genus *Strophostylus* Hall

Strophostylus allani sp. nov.¹

Plate 70, figures 9-15

Description—Shell of medium size to large. The dimensions of the holotype which is a large specimen are: Height 50 mm., width 40 mm. Shell consisting of three rapidly expanding whorls, the inner one rising considerably above the outer; spire of medium height; suture distinct; upper surface of volutions convex, sides obliquely rounded. Aperture entirely sub-circular to broadly oval, and slanting obliquely backward below. Character of inner lip cannot be determined from specimens observed. Surface marked by coarse, irregular lines of growth, and on the outer volution these are crossed at right angles by faintly defined striations.

Remarks—The species resembles *Strophostylus transversus* Hall, from the New York and Maryland Oriskany, but is distinguished by the higher spire, and the more distinctly irregular and imbricating lines of growth.

Horizon—Lower beds.

Holotype and Paratypes No. 27509, *Walker Museum*.

¹This species has been named after Professor J. A. Allen, head of the Department of Geology, University of Alberta, Edmonton, Alberta, Canada.

Order Ctenobranchiata

Suborder Platypoda

Superfamily Ptenoglossa

Family Capulidae

Genus *Orthonychia* Hall*Orthonychia belli* Clarke

Plate 67, figure 6

1908. *Platyceras (Orthonychia) belli* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 147, pl. 14, figs. 20, 21.

Description—Shell erect, of medium size. The dimensions are: Length about 45 mm., width of aperture 30 mm. Outline of shell conical, expanding very gradually but uniformly for about half its length. The expansion becoming more abrupt for the remainder of the distance. Apex missing. Aperture essentially circular, peristome undulating. Surface features obscure.

Remarks—An incomplete specimen only has come under observation. The apex of the shell is lacking, and its character unknown, but the remainder of the specimen seems to conform in all details with the form occurring in the Grand Grève beds at Gaspè.

Horizon—Upper beds.

Figured specimen No. 27512, Walker Museum.

Orthonychia praeconicum sp. nov.

Plate 68, figures 1, 2

Description—Shell of medium size, erect, conical to pyramidal, apex missing; height approximately 35 mm., maximum width of aperture 26 mm. Body volution entirely straight, expanding rapidly and becoming extremely ventricose, marked with four or five well-defined longitudinal ridges and depressions, which become obsolete about one-third of the distance from the apex. The depressions are broad and shallow in the middle of the shell, and become still broader and more conspicuous near the aperture; ridges round and prominent. Aperture having a sub-triangular outline; peristome apparently deeply sinuous.

Remarks—This species approaches *Platyceras (Orthonychia) conicum* Hall, but has a more pronounced pyramidal outline, and the aperture is more distinctly quadrangular. On the small patch of shell which remains attached to the casts, no trace of nodose striae such as characterize the above-mentioned species has been observed. It is of interest to note that the Little Saline specimens show a closer resemblance to the Hamilton examples that have been figured than to those from the Onondagan.

Horizon—Upper beds.

Holotype No. 27528, Walker Museum.

Orthonychia tortuosa (Hall)

Plate 67, figures 7-10

1859. *Platyceras tortuosum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 472, pl. 113, figs. 1-5, 1861.
1908. *Platyceras tortuosum* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 146, pl. 14, figs. 22-25.

1913. *Orthonychia tortuosa* Ohern, Geol. Surv., Md. Low. Dev., p. 469, pl. 79, figs. 10-12.

Description—Shell erect, elongate, conical, ascending spirally and forming slightly more than one volution; whorls widely separated and expanding regularly to the aperture. Inner side of spire distinctly corrugated spirally. Aperture sub-circular, peristome undulated. Surface marked with fine concentric striae, which are closely crowded, wavy and parallel the undulations of the peristome.

Remarks—This species presents considerable variety in shape, rapidity of expansion of volutions, and in the distinctness of the corrugations. An average individual measures from 45 to 50 mm. from apex to peristome, while larger forms measure as much as 65 mm. in height, hence displaying a closer relationship in size to the Gaspe forms than to those of New York. Internal casts only occur, in a few cases with portions of the shell attached. The corrugations apparently are not a persistent feature, in some examples they are strongly marked, in others practically absent.

Horizon—Lower beds.

Figured specimen No. 27513, Walker Museum.

Genus *Platyceras* Conrad

Platyceras angulare Rowe

Plate 68, figures 3, 4

1913. *Platyceras angulare* Rowe, Geol. Surv., Md. Low. Dev., p. 476, pl. 85, fig. 3.

Description—Shell moderately elevated, sub-conical, sides sloping regularly from aperture to apex, one whorl. Apex incurved but free; aperture elongate oval in outline. The shell substance is missing, but the cast shows from 4 to 6 angular, longitudinal ridges occurring at irregular distances from each other, and separated by broad, shallow depressions, and extending from the aperture to very near the apex where they become obsolete. Indistinct elongate nodes mark the ridges. The dimensions are: Length from beak to outer edge of aperture 37 mm., length of aperture 27 mm., width of aperture 25 mm.

Remarks—One specimen, a cast of the interior has been observed. The general depressed appearance, and the sharp angular ridges separated by broad shallow grooves, suggest its affinity with the species described by Rowe. The specimen reveals in addition the character of the apex, and the general outline of the aperture.

Horizon—Lower beds.

Figured specimen No. 27514, Walker Museum.

Platyceras depressum sp. nov.

Plate 69, figures 15, 16

Description—Shell of medium size, depressed ovoid, consisting of three closely contiguous whorls; spire depressed below plane of body volution whose upper side is inclined toward the depressed spire. Lateral surface sloping obliquely downward, slightly concave, giving rise to a ridge-like lateral border. Whorls gradually expanding from apex to aperture, the aperture not well shown, but apparently vertical, and from triangular to sub-quadrilateral in outline. Suture lines deeply impressed.

Basal view showing a wide, deep umbilicus. Surface characters obscure; a small portion of shell adhering near the umbilicus exhibits indistinct transverse striae which have a tendency to sinuosity. Exterior surface rough, but not nodose as in *Platyceras nodosum* Conrad. Surface of the cast generally rough, possibly indicating a rough or somewhat nodose shell surface.

Remarks—There are present in the collection two entire casts and a fragmentary portion of a third. This species is distinguished from all the other *Platycerids* present

in the fauna by the depressed spire, the inclination of the upper side of the body whorl toward the spire, and the obliquely sloping lateral sides which make, with the upper side, a moderately sharp angle.

Horizon—Lower beds.

Holotype and Paratypes No. 27518, *Walker Museum*.

Platyceras dumosum Conrad

Plate 68, figure 5

1840. *Platyceras dumosum* Conrad, Third Ann. Rept. Pal. Dept. N. Y. Surv., p. 205.

1879. *Platyceras dumosum* Hall, Nat. Hist. N. Y. Pal., vol. 5, pt. 2, pl. 14, pl. 5, figs. 11-16 and pl. 6, fig. 1.

Description—Shell small, subovoid, consisting of about three whorls, the first two contiguous, and the third or body whorl becoming free and expanding rapidly; spire depressed below the plane of the body volution. Character of aperture obscure. Surface marked by closely spaced, concentric, sinuous striae. At irregular intervals on the longitudinal ridges there are projecting nodes which are extended into spines of uncertain length.

Remarks—One imperfect specimen may be referred to this Onondagan species. The form is smaller than those figured in the New York reports and may possibly be an immature individual. The spinose character of the surface is very distinctive of the species.

Horizon—Upper beds.

Figured specimen No. 27527, *Walker Museum*.

Platyceras elongatum var. *parvum* n. var.

Plate 68, figure 6

Description—Shell erect, elongate conical, slightly curved, curvature near the apex most pronounced. One or two curving undulations are present near the aperture; aperture not fully preserved, but presumably sub-circular to circular in outline. Surface essentially smooth.

Remarks—One specimen only has come under observation. It resembles the young specimen of *Platyceras elongatum* Hall, with the exception that the longitudinal and transverse striations are absent. The curving undulations give the shell a twisted appearance not noticeable in *Platyceras elongatum*, but such irregularities might be considered as an accidental feature in growth, rather than a diagnostic specific character, and it seems best to consider this form as a variety of the above species.

Horizon—Lower beds.

Holotype No. 27525, *Walker Museum*.

Platyceras gebhardi Conrad

Plate 68, figures 7-10

1859. *Platyceras gebhardi* Conrad, Nat. Hist. N. Y. Pal., vol. 3, p. 312, pl. 56, figs. 5a, 5b, 6, 7, 9; pl. 55, figs. 6a-b.

Description—Shell small, volutions expanding obliquely and rather rapidly. Spire composed of three or four contiguous volutions, apex in general plane of body whorl or slightly below. Suture line deeply marked; aperture rounded or subovate, in some specimens expanded. Surface finely striate transversely. The dimensions of an average sized individual are: Height 13 mm., height of aperture approximately 11 mm., width 10 mm.

Remarks—This form is represented chiefly by casts, and only fragments of the shell substance are preserved. The specimens are smaller than those from the Oriskany of New York, but in other respects agree with them.

Horizon—Lower beds.

Figured specimens No. 27522, Walker Museum.

Platyceras cf. gracile Ohern

Plate 68, figures 11-13

1913. *Platyceras gracile* Ohern, Geol. Surv., Md. Low. Dev., p. 478, pl. 85, figs. 10-13.

Description—Shell small, sub-conical, ascending spirally, whorls a little more than one, free; shell expanding regularly from apex to aperture; aperture circular to sub-circular in outline; peristome not observed. The dimensions of a large specimen are: Height 30 mm., greatest diameter of aperture 16 mm. The proportionate height and breadth in individuals varies to a marked degree. A fragment of shell substance adhering to the cast shows the surface marked by irregular, transverse striations. Most of the specimens have distinct spiral corrugations extending from the aperture up to or almost to the apex. Apex missing in all specimens examined.

Remarks—This shell bears a close resemblance to *Platyceras gracile* Ohern, from the Maryland Oriskany, but it is considerably smaller, and does not have the apex so nearly in the plane of the right side of the aperture. Also some of the Little Saline forms are more nearly erect than those from Maryland.

Horizon—Lower beds.

Figured specimens No. 27523, Walker Museum.

Platyceras magnificum Hall

Plate 68, figures 14-17

1859. *Platyceras magnificum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 476, pl. 119, figs. 1-6, 1861.

1913. *Platyceras magnificum* Ohern, Geol. Surv., Md. Low. Dev., p. 472, pl. 82, figs. 1-6.

Description—"Shell obliquely subovate. Spire depressed below the plane of the outer volution; volutions two or three, very rapidly expanding and becoming extremely ventricose below; usually free or with the first one contiguous, aperture expanded sub-circular, campanulate, and often with the margin reflexed, particularly on the left side. Surface marked by distinct, transverse, lamellose, undulating striae."—Hall, 1859.

Remarks—The specimens in the collection are all casts of the interior, but patches of shell are attached and display sinuous lines of growth. The species differs from *Diaphorostoma ventricosum* Hall, in the more rapid expansion of the whorls, in the freedom of the volutions, and in the wider and more expanded aperture. Character of peristome obscure in all specimens observed.

Horizon—Lower beds.

Figured specimens No. 27529, Walker Museum.

Platyceras cf. multisinuatum Hall

Plate 69, figure 1

1859. *Platyceras multisinuatum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 319, pl. 58, figs. 8a, b, c and 9a, b, 1861.

1913. *Platyceras multisinuatum* Ohern, Geol. Surv., Md. Low. Dev., p. 477, pl. 85, figs. 4-6.

Description—"Shell subdiscoid in the young state; apex nearly on a plane with the outer volution; volutions about three, the first one minute; outer one becoming

free, ventricose, rounded or scarcely angular below, somewhat flattened on the upper side, marked by several ridges and shallow depressions on the upper and dorsal sides; aperture somewhat longitudinally oval; peristome sinuate, with a deeper sinuosity on the anterior margin. Surface marked by fine, transverse striae, which are strongly undulated on the inequalities of the shell, and crossed by fine longitudinal or revolving striae."—Hall, 1859.

Remarks—Only a single fragmentary cast has come under observation. The general shape of the specimen corresponds closely to the above species, and the dorsal side exhibits the characteristic longitudinal ridges. Apex, surface striae, and character of peristome not observed. Aperture probably longitudinally oval or subcircular.

Horizon—Lower beds.

Figured specimen No. 27515, Walker Museum.

Platyceras cf. newberryi Hall

Plate 69, figure 2

1859. *Platyceras newberryi* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 333, pl. 63, figs. 14a-c, 1861.

1913. *Platyceras newberryi* Ohern, Geol. Surv., Md. Low. Dev., p. 479, pl. 86, fig. 4.

Description—Shell small, subdiscoidal, with about three volutions, the last one expanding rapidly and becoming almost ventricose, the first two small and closely coiled; aperture not well preserved, probably circular or transversely oval. Surface marked by widely and irregularly spaced, transverse, sinuous plications. These are crossed by closely packed, and regular longitudinal striations.

Remarks—The one specimen present in the collection is fragmentary, but near the apex a portion of the shell substance is preserved, which shows the surface markings in fine detail. In shape there is a close resemblance between this specimen and *P. newberryi*, but the surface ornamentation differs; the transverse plications being more widely spaced, more distinct, and more sinuous than in the specimens figured by Hall. The transverse ridges are lacking, although there is a suggestion of them in the plications, which on the lower part of the portion of shell adhering, become distinctly coarse and lamellose. There is no suggestion of flattening in the preserved part of the shell.

This specimen is evidently not identical with *P. newberryi*, although the general shape and strong development of the longitudinal striae suggest a close relationship.

Horizon—Lower beds.

Figured specimen No. 27519, Walker Museum.

Platyceras nodosum Conrad

Plate 69, figures 3-6

1841. *Platyceras nodosum* Conrad, Ann. Rept. Pal. N. Y., p. 56.

1859. *Platyceras nodosum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 473, pl. 115, figs. 1-6; pl. 116, figs. 1-4, 1861.

1913. *Platyceras nodosum* Ohern, Geol. Surv., Md. Low. Dev., p. 469, pl. 79, figs. 13, 14.

Description—Shell of medium size. The dimensions of an average individual are: Height 45 mm., diameter 25 mm. Spire depressed, consisting of three or four rapidly expanding volutions. In cross-section the whorls present an oval outline, the upper side convex, the lateral side also convex and obliquely inclined to the upper. Surface marked with spinose nodes, having no definite arrangement. Original shell present in one small patch shows transverse, strongly marked, sinuous lamellae. Character of aperture and peristome obscure.

Remarks—This species is represented sparsely in the lower beds, but somewhat more abundant in the upper. In general the specimens are smaller than those from the

New York Oriskany, but very similar in size to the ones occurring at Cumberland, Maryland.

Horizon—Lower and upper beds.

Figured specimens No. 27521, *Walker Museum*.

Platyceras peregrinus sp. nov.

Plate 69, figures 13, 14

Description—Only a fragmentary portion of one shell has been observed. Shell depressed, discoidal, whorls probably not more than one; apex of spire incomplete, but apparently obtuse; younger portion of the shell less compressed than later stages, the more pronounced compression beginning rather suddenly about one-third the distance from the apex. Suggestions of parallel transverse undulations are present in the older part of the shell. Character of aperture not observed.

Remarks—This form may be distinguished from all the other *Platycerids* present in the fauna because of the strong lateral compression. In general shape the specimen agrees best with *Platyceras compressum* Clarke and Swartz, from the Chemung of Maryland, but expansion of the whorl is more rapid in that form, and compression begins closer to the apex. Some resemblance to *Platyceras whitii* Clarke, from the Devonian of Para, is also suggested, but the dorsal ridge of that form is absent here.

Horizon—Lower beds.

Holotype No. 27517, *Walker Museum*.

Platyceras planovolvis sp. nov.

Plate 70, figures 1-5

Description—Shell medium to large, discoidal, consisting of 3 or 4 gradually but rapidly expanding whorls, which in the majority of the specimens are closely coiled in one plane; whorls contiguous with the exception of one or two specimens and in these the outer volution is free; spire in same plane or very slightly depressed below body volution. In cross section the whorls present a circular to an oval outline.

Aperture entire, shape varying from sub-circular or transversely oval to longitudinally oval, expanded, almost campanulate; outer lip of peristome extended, inner contiguous with body volution. Upper side of body whorl slightly flattened to gently and evenly convex.

Surface marked by transverse striae, closely packed, and undulating. A few of the specimens show traces of transverse ridges.

Remarks—This is the most abundant species of the genus in the Little Saline limestone and is distinct from all the associated species by reason of the character of coiling in one plane. It is represented by the internal casts only; rarely these have portions of the shell attached which reveal the surface features. The specimens present a distinct variation in size, in outline of aperture, in rapidity of expansion of whorls, and in amount of depression of spire, but all exhibit the same even manner of coiling in one plane, and the expanded aperture.

Horizon—Lower and upper beds.

Holotype and Paratype No. 27526, *Walker Museum*.

Platyceras reflexum Hall

Plate 69, figures 7-9

1859. *Platyceras reflexum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 477, pl. 120, figs. 1-7, 1861.

1913. *Platyceras reflexum* Ohern, Geol. Surv., Md. Low. Dev., p. 473, pl. 83, figs. 5, 6; pl. 84, figs. 1, 2.

Description—Shell of medium size, spirally ascending, sub-conical in outline; apex consisting of two or three closely coiled but free volutions. Body whorl expanding regularly, and towards the aperture somewhat rapidly; aperture almost circular and rather broadly expanded; character of peristome obscure. Fine, undulating, and closely crowded transverse striae mark the surface.

Remarks—This species is represented by some small specimens which are apparently young individuals, and by several incomplete large forms which are doubtfully referred to the same species. They display a considerable variation in the rapidity of expansion of the body whorl, and in the amount of expansion of the aperture, but in general they closely approximate the above species.

Horizon—Lower beds.

Figured specimens No. 27530, Walker Museum.

Platyceras retrorsum Hall

Plate 69, figure 10

1859. *Platyceras retrorsum* Hall, Nat. Hist. N. Y. Pal., p. 320, pl. 58, figs. 10a, b, 6c; pl. 59, figs. 9a, b.

Description—Shell of medium size, depressed, ascending spirally, whorls about two, free; the first whorl nearly smooth, while the second or body whorl is marked with widely spaced, spiral ridges or corrugations, which are absent on the ventral side of the shell. Dorsal side flattened, the apex a little elevated above the outer volution of the shell. Surface marked transversely by fine, closely spaced, sinuous striae. Aperture not definitely known, probably subcircular with undulating peristome.

Remarks—One exfoliated individual occurs which has portions of the shell attached. Apart from its smaller size, there seems to be no essential difference from the specimens in the Lower Helderberg of New York.

Horizon—Lower beds.

Figured specimens No. 27524, Walker Museum.

Platyceras cf. subconicum Ohern

Plate 69, figure 11

1913. *Platyceras subconicum* Ohern, Geol. Surv., Low. Dev., p. 479, pl. 86, figs. 1-3.

Description—Shell small, obliquely conical, whorls probably one; shell expanding fairly rapidly from apex to aperture; apex broken but it appears to have been blunt and twisted slightly to the right. Aperture and peristome obscure; surface features not preserved.

Remarks—The specimens are entirely too fragmentary for certain determination, and the reason for referring the specimen to this species is because of the evident correspondence in shape with authentic specimens in the collection of Walker Museum.

Horizon—Lower beds.

Figured specimen No. 27520, Walker Museum.

Platyceras trilobatum Hall

Plate 69, figure 12

1859. *Platyceras trilobatum* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 316, pl. 57, figs. 5a, b, c, 1861.

1913. *Platyceras trilobatum* Ohern, Geol. Surv., Md. Low. Dev., p. 475, pl. 84, figs. 7, 8.

Description—"Body of shell obliquely or arcuately ovoid, trilobate; volutions three or four, the last one (or more) becoming free, gradually expanding to the aperture; the apex closely involved and rising above the plane of the outer volution, or sometimes

on the same plane, concave toward the suture; aperture subangularly ovate, sinuate on the right and left sides, and the shell extended in front. Surface marked by two strong, spiral depressions corresponding to the sinuosities of the aperture, and crossed by lamellose striae which are strongly undulated on the sinuosities of the last volution, and are marked by other undulations on the earlier volutions, indicating former sinuosities in the margin of the aperture."—Hall, 1859.

Remarks—An incomplete and exfoliated specimen is the only example representing this species. The apex is missing, hence the character of the complete specimen cannot be definitely determined. The distinctly trilobate form, and the clearly defined spiral depressions are the characters used to identify the species. Surface is irregular, lumpy, or nodose in character. Shell surface unknown.

Horizon—Lower beds.

Figured specimen No. 27516, Walker Museum.

Genus *Diaphorostoma* Fisher

Diaphorostoma ventricosum (Conrad)

Plate 70, figures 6-8

1859. *Platystoma ventricosa* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 300, pl. 55, fig 9a, b, c; p. 469, pl. 112, figs. 1-10; pl. 113, figs. 7, 8; pl. 115, fig. 8, 1861.
 1892. *Platystoma ventricosa* Conrad, Jour. Acad. Nat. Sci., Phila., vol. 8, p. 275, pl. 17, fig. 5.
 1900. *Diaphorostoma ventricosum* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 30, pl. 3, figs. 25-28.
 1913. *Diaphorostoma ventricosum* Ohern, Geol. Surv., Md. Low. Dev., p. 482, pl. 87, figs. 1, 2.

Description—Shell globose, spire slightly elevated, in a few cases depressed; whorls three, closely coiled, expanding rapidly until the last one or body whorl becomes highly ventricose; volutions flattened on upper side, curving obliquely on the lower, giving the shell a twisted appearance. Aperture subcircular, greatest diameter 40 mm., inner lip of peristome reflexed. Surface of shell marked by indistinct transverse striae, which parallel the lines of growth.

Remarks—This species is fairly abundant in the collection, both mature and immature individuals being present. The flattened upper surface, and the pronounced ventricosity of the body volution characterize all the specimens. Some of the smaller ones may be readily confused with *Diaphorostoma depressum* Conrad, and the only apparent distinction is the greater tendency to ventricosity in the outer volution.

Horizon—Lower and upper beds.

Figured specimens No. 27508, Walker Museum.

Order Opisthobranchia

Suborder Pteropoda

Family Hyolithidae

Genus *Hyolithes* Eichwald

Hyolithes cf. oxyis Clarke

Plate 69, figure 17

1908. *Hyolithes oxyis* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 143, pl. 12, figs. 10-13.

Description—Shell large, conical, sides tapering gradually, length approximately 42 mm., diameter of aperture 16 mm. Dorsal face strongly convex; ventral face not

observed. Surface marked by concentric striae which bend slightly upwards towards the aperture. At irregular, but wide intervals there are shallow depressions paralleling the striae; these are especially noticeable near the aperture.

Remarks—The interior of the dorsal side has been observed. The form bears a close resemblance to the large specimen of *Hyolithes oxys* Clarke, with this difference, that the longitudinal grooves present in that form are lacking here, and the concentric striae bend towards the aperture instead of towards the apex.

Horizon—Lower beds.

Figured specimen No. 27510, Walker Museum.

Suborder Conulariida

Family Tentaculitidae

Genus *Tentaculites* Schloth

Tentaculites elongatus Hall

Plate 69, figure 18

1859. *Tentaculites elongatus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 136, pl. 6, figs. 16-21, 1861.
 1908. *Tentaculites elongatus* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 118, pl. 12, figs. 8, 9.
 1913. *Tentaculites elongatus* Ohern, Geol. Surv. Low. Dev., p. 485, pl. 87, figs. 8-10.

Description—A few fragmentary specimens belonging to this species occur. The elongate and tapering form, and the strongly marked annulations are unmistakable evidence of their identity with this common Oriskany species. The absence of the fine, closely arranged annular striae which are characteristic of this species, is doubtless due to the condition of preservation.

Horizon—Lower beds.

Figured specimen No. 27511, Walker Museum.

ARTHROPODA

Class CRUSTACEA

Subclass Trilobita

Order Opisthoparia

Family Odontopleuridae

Genus *Acidaspis* Murchison

Acidaspis sp. undet.

Plate 71, fig. 1.

Description—This species is represented by a single fragmentary cranidium, apparently semi-circular in outline, glabella convex, elongate and narrow, sides straight, separated from lateral lobes by distinct longitudinal furrows. Posterior lateral lobes well defined, small, suboval, anterior pair obsolete or missing entirely. Occipital furrow broad and shallow, but behind the posterior lateral lobes depressed into deep, circular pits. Occipital segment well defined, covered with pustules. Surface of glabella and lateral lobes also marked with pustules which vary considerably in size.

Cheeks, thorax and pygidium unknown.

Remarks—The material present in the collection is entirely too fragmentary for certain determination, but the form corresponds fairly closely with *Acidaspis tubercalatus* Hall. It differs in the obsolescence of the anterior lobes, and the better definition of the occipital segment.

Horizon—Lower beds.

Figured specimen No. 27548, *Walker Museum*.

Family Proetidae

Genus *Proteus* Steininger

Proetus conradi Hall

Plate 71, figure 2

1900. *Proetus conradi* Clarke, N. Y. State Mus., Mem. vol. 3, No. 3, p. 25, pl. 2, figs 11-16.

1908. *Proetus phocion* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 135, pl. 9, figs. 14-16.

Description—An incomplete cephalon is the only example representing this species. The specimen possesses a subtriangular, strongly convex glabella with both extremities well rounded, the anterior portion forming the apex of the triangle. Length slightly greater than the width. The species is characterized by a flat marginal border which is separated from the rest of the cephalon by a shallow groove. Cheeks gently convex, borders flattened.

Remarks—The strongly convex subtriangular glabella, together with the flattened marginal border, are the characters used for the determination of this specimen.

Horizon—Lower beds.

Figured specimen No. 27550, *Walker Museum*.

Proetus cf. pachydermatus Barrett

Plate 71, figure 3

1903. *Proetus pachydermatus* Weller, Pal. N. J., vol. 3, p. 248, pl. 22, figs. 16-21.

1913. *Proetus pachydermatus* Maynard, Geol. Surv., Md. Low. Dev., p. 489, pl. 89, fig. 1.

Description—This species is represented by several fragmentary, exfoliated cephalon. Cephalon small, semi-circular, with a broad, depressed convex, marginal border. Glabella elongate oval, or subtriangular, moderately convex, anterior margin rounded, posterior margin straight, the whole set off from the rest of the cephalon by a distinct bordering furrow, or sulcus. The two anterior pairs of glabellar furrows are obsolete, the third pair is pronounced, and curving to connect with the occipital furrow, thus forming two distinct lobes at the base of the glabella.

Cheeks poorly preserved, free cheeks entirely lacking. Facial sutures and other characteristics not shown in the incomplete specimens.

Remarks—The form resembles *Proetus pachydermatus* Maynard from the Helderberg of Maryland, but lacks the small basal lobes situated posterior to the glabella basal lobes.

Horizon—Lower beds.

Figured specimen No. 27549, *Walker Museum*.

Proetus protuberans Hall

Plate 71, figures 4-7

1859. *Proetus protuberans* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 351, pl. 73, figs. 5-8, 1861.

1902. *Proetus protuberans* Weller, Geol. Surv. N. J., vol. 3, p. 296, pl. 32, fig. 2.
 1913. *Proetus cf. protuberans* Ohern, Geol. Surv., Md. Low. Dev., p. 490, pl. 89, figs. 2-4.

Description—Pygidium small, semi-circular, axis conical, conspicuously elevated, having 7 or 8 annulations. Lateral lobes with 4 or 5 depressed pleura. Distinct, flattened marginal border present.

Two glabellae occurring in the upper beds apparently belong to this species. These are prominent, broadly rounded in front, with indistinct lobing, tapering gradually to frontal margin, only a slight portion of which is preserved.

Remarks—With the exception of the smaller size, the specimens do not show any essential differences from those figured from the New York Oriskany.

Horizon—Lower and upper beds.

Figured specimens No. 27546 *Walker Museum*.

Proetus sp.

A number of pygidia of *Proetus* are present in the upper beds too imperfectly preserved to be identified.

Family Lichadidae

Genus *Lichas* Dalman

Lichas sp.

Plate 71, figures 8, 9

A few fragments of the cephalon of a large Lichad occur which are not determinable. The surface is covered with prominent pustulae of variable size, and might suggest such a species as *Lichas pustulosus* Hall.

Horizon—Lower beds.

Figured specimens No. 27544, *Walker Museum*.

Genus *Ceratolichas* Hall and Clarke

Ceratolichas gryps Hall

Plate 71, figures 13-15

1876. *Acidaspis* n. sp? Illustrations of Devonian Fossils, pl. 19, fig. 1 (not figs. 2 and 3).
 1888. *Lichas (Ceratolichas) gryps* Hall, Pal. of New York, vol. 7, p. 84, pl. 19b, figs. 7-13.

Description—Glabella large, embracing nearly the entire cephalon. Frontal lobe elliptical, convex or tumid, elevated behind, sloping abruptly to the sides and the posterior margin, and becoming obsolete at or just behind the centre of the shield. It bears at its summit two strong, diverging, recurved spines, which nearly equal the glabella in length. Longitudinal furrows subparallel, diverging near the frontal margin. Lateral lobes depressed, becoming obsolete; the members of the first and second pairs have coalesced, and the third pair can be detected only as low, obsolescent nodes bearing a faint tubercle. Near the outer edge of the lateral lobes, and just within the eye lobes, are slender erect spines, usually represented by the broken bases.

The anterior slope of the glabella is broad and nearly vertical, the occipital furrow narrow, and the occipital ring broad upon the axis, arched and bearing at its centre two long, divergent spines which are curved downward and slightly inward toward their tips. In the single specimen observed which retains one spine apparently entire, its length is nearly equal to the length of the cephalon. Eye lobes small, inconspicuous.

Surface bearing tubercles which are closely disposed over the frontal lobes, but are scattered or obsolescent on the lateral lobes. On the posterior slope of the frontal lobe these tubercles appear to be arranged in two longitudinal rows of three or four each. The spines of the head shield are covered with acute pustules and granules. " Hall, 1888.

Remarks.—A fragmentary glabella corresponds with the descriptions and illustrations of this species as shown in the New York Palaeontology.

Horizon.—Upper beds.

Figured specimen No. 27543, Walker Museum.

Order Proparia

Family Phacopidae

Genus *Dalmanites* Barrande

Dalmanites cf. aspinosus Weller

Plate 71, figures 10, 11

1903. *Dalmanites aspinosus* Weller, Pal. N. J., vol. 3, p. 252, pl. 22, fig. 15.

1913. *Dalmanites aspinosus* Maynard, Geol. Surv., Md. Low. Dev., p. 499, pl. 91, fig. 16.

Description.—Three incomplete pygidia comprise the only material available for study. The dimensions of the largest specimen are approximately: Length 18 mm., width 26 to 27 mm. Semi-elliptical in outline, posterior pointed. Axis only partly preserved, tapering uniformly, and reaching to within 2 mm. from the posterior margin; the portion preserved divided into 10 annulations which posteriorly become obscure. Lateral lobes with 8 curved pleural, angular and prominent, oblique to the lateral margins; shallow grooves separate the pleura.

Remarks.—With such inadequate material the identification of these specimens with *Dalmanites aspinosus* Weller, is uncertain, but the sharp angular pleural ribs extending to the lateral margins of the pygidium, and the absence of any marginal border, strongly suggest this species. From the incomplete pygidia neither the number of pleural ribs, nor the axial annulations can be certainly determined. In size the specimens are comparable to those from the Maryland Oriskany. Those from New Jersey as figured by Weller are considerably larger.

Horizon.—Lower beds.

Figured specimens No. 27541, Walker Museum.

Dalmanites cf. bisignatus Clarke

Plate 71, figure 12

1903. *Dalmanites bisignatus* Clarke, Mem. N. Y. State Mus., vol. 3, No. 3, p. 19, pl. 2, figs. 6-8.

Description.—Pygidium distinctly triangular, length greater than width, pleural lobes sloping steeply to the lateral margins; posterior margin apparently extended into a flattened spine. Axis convex, tapering, sides straight or slightly concave; portion preserved divided into 12 segments. Lateral lobes strongly convex, with 14 segments, separated by broad, flat grooves. Ribs flat, well defined to lateral margin and divided longitudinally by fine median depressions. No marginal border present. Surface ornamentation indistinct, consisting of a few, nearly obsolete pustules on the axial portion.

Remarks.—This form is represented by a single imperfect pygidium which hardly merits specific determination. It resembles *Dalmanites bisignatus* as figured by Clarke

from the Becraft Mountain Oriskany, New York, State, and may be compared with that species. In contrast it has a greater number of axial annulations, and lacks the characteristic surface ornamentation of that species.

Horizon—Lower beds.

Figured specimen No. 27538, Walker Museum.

Dalmanites micrurus ? (Green)

Plate 71, figure 22

1832. *Asaphus micrurus* Green, Monograph, Trilobites, N. Amer., p. 56, fig. 3.
 1859. *Dalmania micrurus* Hall, Nat. Hist. N. Y. Pal., vol. 3, p. 359, pl. 74, figs. 13-20.
 1908. *Dalmanites micrurus* Clarke, Mem. N. Y. State Mus., vol. 9, pt. 1, p. 120, pl. 9, figs. 1-3.
 1913. *Dalmanites micrurus* Ohern, Geol. Surv., Md. Low. Dev., p. 507, pl. 91, figs. 10-11.

Description—A few incomplete cephalia exhibit certain definite characters of this species. Frontal lobe large, showing transverse subrhomboidal outline, three pairs of lateral lobes sharply defined; eyes prominent, large; cheeks separated from glabella by deep, strongly marked dorsal furrows. Entire surface finely pustulose. Because of the absence of the frontal border which is a feature of the species, one cannot be reasonably sure of the correctness of the identification, but the general shape, and complete separation of the lateral lobes together with the pustulose surface strongly suggest *D. micrurus*.

Horizon—Upper beds.

Figured specimen No. 27542, Walker Museum.

Dalmanites cf. pleuroptyx (Green)

Plate 71, figure 16

1832. *Asaphus pleuroptyx* Green, Mon. of Trilobites of North Amer., p. 55.
 1888. *Dalmanites (Hausmania) pleuroptyx* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 7, p. 28, pl. 11a, figs. 1-3.
 1913. *Dalmania (Hausmania) pleuroptyx* Ohern, Geol. Surv., Md. Low. Dev., p. 510, pl. 93, figs. 6-10.

Description—One incomplete pygidium may be compared with this species. It is depressed convex, triangular in outline with the axis depressed in the posterior region, 8 annulations present in part preserved; the intermediate furrows are deep and narrow, obsolete down the center of the axis. Pleural lobes with broad segments, total number unknown, divided longitudinally by faint median depressions, intermediate furrows narrow and shallow. Ribs strongly oblique posteriorly; lateral margins flattened, indistinct.

Remarks—The specimens observed are too fragmentary to permit certain determination, but the characters preserved strongly suggest *D. pleuroptyx*.

Horizon—Lower beds.

Figured specimen No. 27540, Walker Museum.

Dalmanites slocomi sp. nov.

Plate 71, figure 20

Description—Pygidium broadly triangular, moderately convex, ending posteriorly in a caudal spine. The dimensions of the type specimen are: Length 35 mm., width 45 mm. Axis depressed, conical, margins tapering uniformly, apex rounded, extending to within 5 mm. from the posterior margin, marked by 15 or 16 low, somewhat flat

annulations, which are separated by broad, shallow grooves. Surface ornamentation consisting of two rows of tubercles which become obsolete on the last three or four posterior annulations. Lateral lobes with 12 pleura which slope obliquely to the lateral margins, the 7 or 8 anterior ones divided by distinct longitudinal furrows which persist to the end of each rib; extremities of ribs flattened to form a marginal border having a uniform width of 2 mm., intervening furrows broad. Surface marked by indistinct pustules.

Cephalon and thorax unknown.

Remarks—The form resembles *Dalmanites multiannulatus* Ohern, from the Maryland Oriskany, but is smaller, has fewer axial and pleural segments, less distinct surface ornamentation, and it is especially characterized by the presence of a caudal spine.

Horizon—Lower beds.

Holotype No. 27535, Walker Museum.

Name—This fossil is named after Mr. A. W. Slocum, of Walker Museum, University of Chicago.

Dalmanites cf. stemmatus var. convergens Clarke

Plate 71, figure 17

1892. *Dalmanites* sp. nov. A. var., Amer. Jour. Sci. 1892, p. 412.

1900. *Dalmanites* (*Synphoria*) *stemmaus var. convergens* Clarke, Mem. N. Y. State, Mus., vol. 3, No. 3, p. 19, pl. 2, figs. 3-5.

Description—Pygidium triangular, slender and tapering, width greater than length. Axial region with 12 flattened annulations, the posterior two scarcely discernible; intervening grooves narrow; pleural segments 10, each one divided by a narrow, faintly defined median furrow. Lateral margins gradually converging posteriorly, apparently terminating in a short caudal spine.

Remarks—A single incomplete pygidium resembles the above species. The only difference observed is the presence of the faint median grooves on the pleural segments.

Horizon—Upper beds.

Figured specimen No. 27539, Walker Museum.

Dalmanites sp. undet.

Plate 71, figure 18

There is present in the collection a single specimen of the frontal margin of an unknown species of *Dalmanites*. The outer edge is coarsely denticulate, with 7 or 8 serrations, the two central ones being larger than the others. A resemblance is noted with the frontal margin of *Dalmanites multiannulatus* Ohern, but the Little Saline form is smaller, more evenly dentated, and the bifurcating process is less conspicuous.

Horizon—Lower beds.

Figured specimen No. 27537, Walker Museum.

Dalmanites praenuntia sp. nov.

Plate 71, figure 19

Description—Pygidium of medium size, broadly triangular in outline. The dimensions of the holotype are: Length 14 mm., width 20 mm. Axis attenuate, depressed convex, marked by 12 to 14 annulations; intermediate furrows narrow and shallow. Lateral lobes with a corresponding number of ribs also separated by shallow furrows, each rib divided longitudinally by a fine median groove which bends posteriorly as it approaches the dorsal furrow. At the lateral margins the ribs are slightly flattened

forming a faint border. Posterior margin of pygidium terminating bluntly, and showing the beginning of two rudimentary spines.

Cephalon and thorax unknown.

Remarks—This species is represented by a single complete pygidium. It may be differentiated from all other associated Dalmanites by the character of the posterior margin of the pygidium. In this feature it seems to be a forerunner of such species as *Dalmanites* (*Odontocephalus*) *aegeria* Hall, *Dalmanites* (*Odontocephalus*) *coronatus* Hall, or *Dalmanites* (*Odontocephalus*) *selenurus* Hall, of the New York and Ohio Onondagan fauna, which have the two posterior spines developed in a conspicuous manner.

Horizon—Lower beds.

Holotype No. 27536, Walker Museum.

Genus *Cryphaeus* Green

Cryphaeus sp.

Plate 71, figure 21

Description—Pygidium small, sub-oval, wider than long; the dimensions are: Length 9 mm., width 11 mm. The axial region is characterized by 7 well defined annulations, broad and rounded, each one bearing in the middle a faintly defined node; intervening grooves narrow and shallow. Pleural lobes moderately broad, sloping gradually toward the lateral margin to near the edge where they turn and bend dorsally; each lobe bears 5 annulations which terminate in spines, the character of which cannot be determined from the specimen. Each pleural segment is marked at the abrupt turn by a circular depression which probably represents the base of a short node. Two additional ones are present at the posterior of the pygidium, and from the base of each extends a short spine.

Remarks—A single incomplete pygidium in the collection apparently represents an undescribed species of this genus. In general shape, character of pleura and spines, it resembles *Dalmanites* (*Cryphaeus*) *comis*, but differs in the larger size, in having an additional axial annulation, and in the presence of nodes at the ends of the pleural segments.

Horizon—Upper beds.

Figured specimen No. 27547, Walker Museum.

Genus *Phacops* Emrich

Phacops cristata Hall

Plate 71, figures 23-25

1888. *Phacops cristata* Hall and Clarke, Nat. Hist. N. Y. Pal., vol. 7, p. 14, pl. 6, figs. 1-31, 16-29; pl. 8a, figs. 1-4.

1913. *Phacops cristata* Kindle, Geol. Surv., Md. Mid. Dev., p. 331, pl. 43, figs. 13-15.

Description—Cephalon of medium size, semi-circular in outline, genal angles rounded. The dimensions of a nearly perfect head are: Length 16 mm., width 26 mm. Glabella large, width greater than length, moderately convex, narrow posteriorly, and rapidly expanding anteriorly, giving a subpentagonal outline. Anterior margin prominent and projecting beyond the frontal margin. Laterally the glabella is separated from the cheeks by deep, narrow furrows. The surface is marked by three pairs of glabellar furrows, the anterior and middle two scarcely perceptible, the posterior pair strongly marked, extending about half way across the glabella, and almost cutting off a narrow segment at the base of the head. Cheeks small, confined to the posterior portion of the cephalon, and bounded by a convex margin. Occipital furrow distinct, extending to, and merging in the marginal border.

Eyes large, less elevated than the glabella, and not extending back to the line of the occipital furrow; composed of numerous rows of vertical lenses with hexagonal outline. Surface of glabella coarsely and strongly pustulose.

Thorax not observed.

A few fragmentary pygidia occur in the upper beds which are doubtfully referred to this species. They are semi-circular in outline, moderately convex, with axial lobe elevated and marked with 7 or 8 annulations. Pleural lobes with from 5 to 6 coarse ribs.

Remarks—This species occurs more abundantly in the upper than in the lower beds, and is represented by numerous cephalae, and by a few exfoliated pygidia. The characteristic stout spines of the genal angles have not been observed in the specimens examined. Their absence is probably due to the condition of preservation.

Horizon—Lower and upper beds.

Figured specimens Nos. 27541 and 27532, Walker Museum.

Phacops sp.

Plate 71, figure 26

Description—Pygidium small, semi-circular in outline. The dimensions are: Length 8 mm., width 13 mm. Axis prominent, narrow and tapering, with 7 rounded annulations, the two posterior ones indistinct; intermediate depressions shallow. Pleural lobes with 6 rounded segments also separated by shallow grooves.

Horizon—Upper beds.

Figured specimen No. 27533, Walker Museum.

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DEVONIAN OUTLIER NEAR ROLLA, PHELPS COUNTY.

The recent discovery of an outlier of Devonian near the crest of the Ozark uplift has added new and important data on the geologic history of the Ozark region. It indicates that the Devonian seas extended to a much greater distance over the uplift than has formerly been suspected. The following condensed description is taken from the *Journal of Geology*.¹

Location and General Description.—The Devonian outlier lies about $1\frac{1}{2}$ miles northwest of Rolla, in the N. E. $\frac{1}{4}$ N. W. $\frac{1}{4}$ Sec. 3, T. 37 N., R. 8 W. It is on the east side of the road and lies fifty feet below the crest of the ridge. It occupies a little knoll between two gullies, and when first found consisted of a number of knobs of quartzite projecting from the hill and having a rough alignment. The base was concealed, but just above the top of the outlier were a number of Mississippian boulders, and on the north, west and south at higher and lower levels are outcrops of the Jefferson City formation.

The summit of the ridge is capped by a thin stratum of Pennsylvanian sandstone, and boulders of Pennsylvanian float are found in abundance at lower levels. The Pennsylvanian rests unconformably upon the Jefferson City formation on the east side of the hill. On the west side there appears to be a thin stratum of Mississippian between them, but the exposures are very poor, and the exact relationships are difficult to determine.

An excavation was made along the side of these quartzite masses in an attempt to expose the lower contact. This was not entirely successful, but the excavation showed that there was a continuous ledge of quartzite at least thirty feet long and from three to six feet in thickness, increasing in thickness toward the east. Beyond the limits of the excavation there are a few other knobs of quartzite, probably continuous with the part just described. This makes the total length of the outlier about fifty feet, and its greatest width slightly less.

Lithologic Characteristics.—Lithologically the Devonian rock is a hard, dense quartzite breaking with a splintery fracture. In color it ranges from white through gray to bluish and almost black. The lighter shades predominate. Thin sections show

¹Bridge, Josiah, and Charles, B. E. A Devonian outlier near the crest of the Ozark uplift. *Jnl. Geol.* XXX, p. 450-458

great numbers of well-rounded quartz nuclei with strong evidences of secondary growth. In some sections the grains show as angular interlocking crystals because of this secondary growth; in other sections, large secondarily enlarged grains are separated from each other by a finely crystalline ground mass of the same material. The rock contains numerous cavities, most of which have been formed by the leaching out of large fossils, and on the surfaces of these cavities are to be found many small but perfect crystals of quartz and of limonite pseudomorphous after pyrite. The quartzite is somewhat fractured, and these fractures are filled with a soft, yellow, non-fossiliferous, somewhat conglomeratic sandstone.

From the structure and secondary growth it seems evident that the rock was originally a calcareous sandstone, laid down by an advancing sea against an old land mass. The calcareous matter has been completely leached out, and much of it replaced by silica. The soft, yellow sandstone is of later age, either basal Mississippian or Pennsylvanian.

Paleontology.—Fossils are abundant in the quartzite. They are not evenly distributed, but are most abundant at the base. At the first glance, parts of the stratum appear to be barren, but careful search of almost any fragment will reveal fossils. The fossils all occur as external and internal molds, and in most cases the preservation is excellent. Corals and Mollusca dominate the fauna. Other forms are not common, though individuals of a given species may be very abundant.

The following table gives a list of the species which have been obtained from this quartzite, and also their occurrence at other localities. Column 1 shows species occurring in the Grand Tower formation in southern Illinois; column 2, species occurring in the Jeffersonville beds at Louisville, Kentucky; column 3, species occurring in Michigan; column 4, species occurring in Ohio; and column 5, species occurring in New York.

List of Species identified from the Devonian Quartzite at Rolla, Missouri

	1 Illinois	2 Ken- tucky	3 Mich- igan	4 Ohio	5 New York
Coelenterata:					
<i>Zaphrentis gigantea</i> , Lesueur.		x	x	x	x
<i>Zaphrentis prolifica</i> , Billings.		x	x	x	
<i>Zaphrentis</i> sp.					
<i>Acerularia rugosa</i> (E. and H.)	x	x	x		
<i>Amplexus yandelli</i> (E. and H.)	x		x		
<i>Favosites winchelli</i> , Rominger.		x	x		x
<i>Favosites emmonsii</i> , Rominger.	x	x	x		
<i>Favosites basalticus</i> , Goldfuss.				x	x
<i>Favosites turbinatus</i> (?) Billings.		x	x	x	x
<i>Favosites limitaris</i> , Rominger.		x	x		x
<i>Favosites clausus</i> , Rominger.		x	x		x
<i>Cladopora labiosa</i> (Billings).		x	x		x
Molluscoidea:					
<i>Cystodictya gilberti</i> (?) Meek.	x	H*		x	
<i>Stropheodonta demissa</i> (Conrad)	x	x	?		x
<i>Rhipidomella vanuxemi</i> , Hall.	x	x	x	x	x
<i>Centronella glansfagea</i> , Hall.	x	x	x	x	x
<i>Eunella</i> (?) sp.					
<i>Spirifer divaricatus</i> , Hall.		x		x	x
<i>Spirifer grieri</i> (?) Hall.	x	x		x	x
<i>Martinia maia</i> (?) (Billings).				x	
<i>Nucleospira concinna</i> , Hall.	x	x		x	x
Mollusca:					
<i>Acinodesma occidentale</i> (?) Hall.	x	x			
<i>Conocardium cuneus</i> (Conrad)	x	var.		x	x
<i>Conocardium ohioense</i> , Meek.		x		x	
<i>Bellerophon pelops</i> , Hall.	x	x		x	x
<i>Bellerophon newberryi</i> , Meek.				x	?
<i>Hormotoma maia</i> , Hall.					
<i>Igoceras conicum</i> (Hall)	x	x		x	x
<i>Loxonema robustum</i> (?) Hall.				x	
<i>Cyclonema crenulata</i> , Meek.		x		x	
<i>Callonema bellatula</i> , Hall.		x	x	x	
<i>Callonema humile</i> , Meek.		x		x	
<i>Callonema conus</i> , Kindle.		x			
<i>Tentaculites scalariformis</i> , Hall.	x	x		x	x
<i>Coleolus tenuicinctum</i> , Hall.	x			H	H
<i>Orthoceras</i> sp.					
<i>Gomphoceras</i> sp (2).					
<i>Zittieoceras nereus</i> , Hall.					x
Arthropoda:					
<i>Phacops cristata</i> , Hall.	x	x			x
<i>Proetus clarus</i> , Hall.	x	x			
<i>Dalmanites calypso</i> , Hall.	x	x		x	x

*H indicates that species occurs in the Hamilton at that particular locality.

Correlation.—From the foregoing table it is evident that this fauna is of Onondaga age, and that it is the partial equivalent of the Grand Tower formation of southern Illinois and southeastern Missouri. Its affinities are entirely with the eastern Devonian and have no resemblance to the later Devonian faunas of Iowa and north central Missouri. Of the thirty-seven identified forms, seventeen occur in the Grand Tower formation of southern Illinois, thirty in the Jeffersonville beds of southern Indiana, thirteen in the Onondaga group of Michigan, twenty-two in the Onondaga of Ohio and eighteen in the Onondaga of New York. These figures are not exact and are probably too low, for the faunal lists from the various regions are incomplete and represent compilations in most cases. The most complete lists are those from the Grand Tower formation and from the Jeffersonville beds. Weller and Savage have shown the relationship of the Grand Tower fauna to the Onondaga of the eastern United States.

Savage has also shown that the Jeffersonville beds are the equivalent of the upper portion of the Grand Tower of Illinois. Since more than 80 per cent of the forms occurring at Rolla are also found in the Jeffersonville beds, it seems certain that this outlier belongs to the upper portion of the Grand Tower formation. Certain horizons in this formation are reported to be full of corals, but until the faunal lists for this formation are completed, a closer correlation cannot be made.

Conclusions.—The presence of a Grand Tower outlier at Rolla indicates a much greater submergence of the Ozark uplift during Onondaga time than has commonly been supposed. The nearest outcrops of the Grand Tower formation are at least 100 miles to the east. The St. Francois Mountains, the structural center of the uplift, are directly between the two exposures, and it is not believed that these were covered in Devonian time. In view of the thinning out of the Devonian to the north, it may be assumed that the Onondaga sea extended westward along the southern border of the St. Francois Mountains, and that it may have covered much of the southern portion of the uplift. Further field work may reveal other outliers, which will enable the boundaries of this sea to be traced more definitely.

PLATE NO. 57

PLATE 57

Zaphrentis salinensis sp. nov.

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Fig. 1. Side view of almost complete corallum.

Fig. 2. Side view of small individual.

Zaphrentis cornuformis sp. nov.

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Fig. 3. Side view of a large specimen.

Fig. 4. Lateral view of small individual, slight curvature of specimen not apparent from this view.

Figs. 5-7. Side views of three individuals of different sizes.

Favosites cf. *helderbergiae* Hall

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Fig. 8. Portion of corallum showing mural pores.

Favosites sp.

Page 222.

Figs. 9, 10. Impressions of the epitheca of the concave bases.

Edriocrinus cf. *sacculus* Hall

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Fig. 11. Lateral view of the calyx.



PLATE NO. 58

PLATE 58

Fistulipora acutula sp. nov.

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- Fig. 1. An enlargement of a vertical section showing zooecial tubes, diaphragms, and interstitial tissue. (X20.)
Fig. 2. Enlargement of transverse section showing outline of the zooecia. (X20.)

Fistulipora variolata sp. nov.

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- Fig. 3. Enlargement of vertical section showing character of zooecial tubes and vesicles. (X15.)
Fig. 4. Enlargement of transverse section showing zooecia with well-developed lunaria, and abundant angular interstitial cells. (X15.)

Meekopora sp.

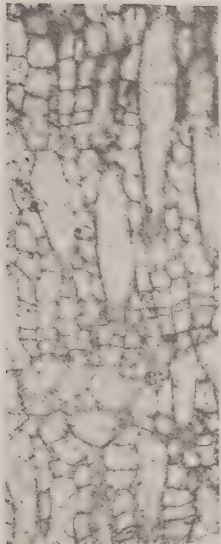
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- Fig. 5. Enlargement showing character of zooecial apertures. (X20.)
Fig. 6. Portion of zoarium, natural size, showing mesathecal surface.

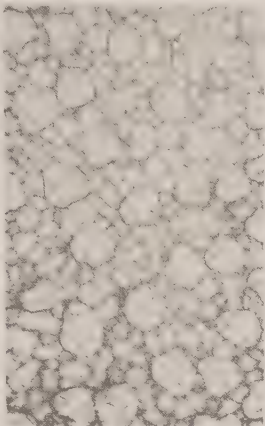
Heterotrypa undata sp. nov.

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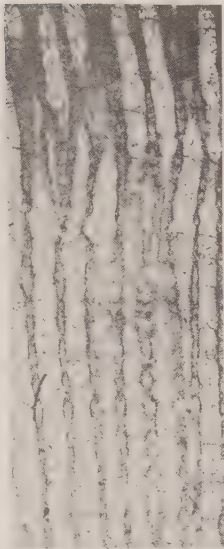
- Fig. 7. Enlargement of vertical section showing abundant diaphragms and undulating cell walls. (X15.)
Fig. 8. Enlargement of transverse section. (X15.)



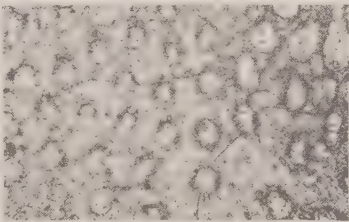
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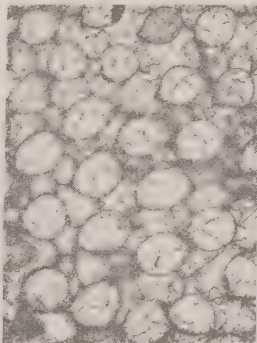
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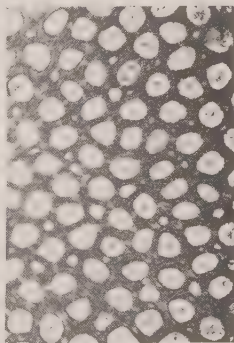
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8

PLATE NO. 59

PLATE 59

Monotrypa cf. tabulata Hall

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- Fig. 1. Enlargement of vertical section showing undulating character of cell walls. (X 20.)
Fig. 2. Enlargement showing angular zooecia without mesapores. (X 20.)
Fig. 3. Transversely fractured zoarium, natural size.

Unitrypa cf. lata Hall.

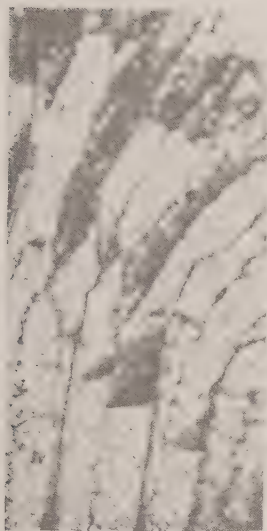
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- Fig. 4. Enlargement of horizontal section showing characters of superstructure, fenestrules, and zooecia. (X 5.)

Unitrypa subcircularis sp. nov.

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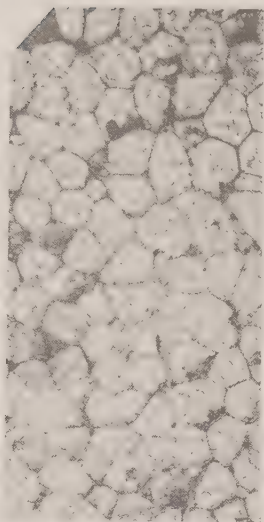
- Fig. 5. Portion of frond, showing impression of superstructure. (X 5.)
Figs. 6, 7. Enlargements of horizontal sections, showing characters of the superstructures. (X 15, 20.)



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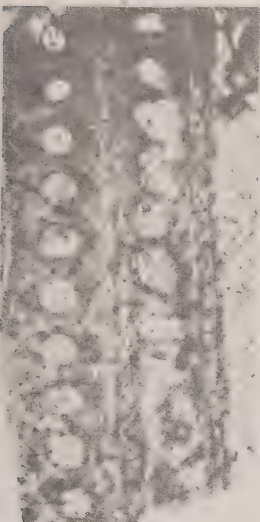
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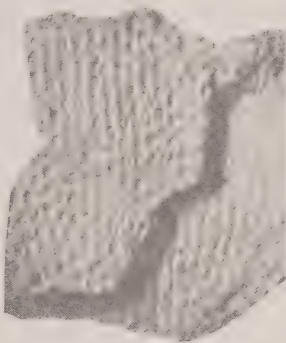
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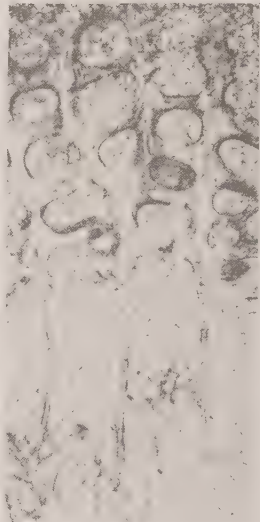
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Polypora cf. hexagonalis Hall

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- Fig. 1. Enlargement of portion of frond, reverse side. (X 3.)
Fig. 2. Enlargement of portion of frond, obverse side. (X 3.)

Polypora media sp. nov.

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- Fig. 3. Enlargement of horizontal section, showing characters of fenestrules, zooecia, and the slightly sinuous branches. (X 5)

Polypora valida sp. nov.

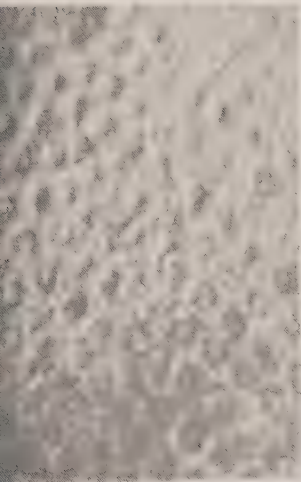
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- Fig. 4. Enlargement of portion of the frond, reverse side, showing strong branches. (X 3.)
Fig. 5. Enlargement of horizontal section. (X 5.)

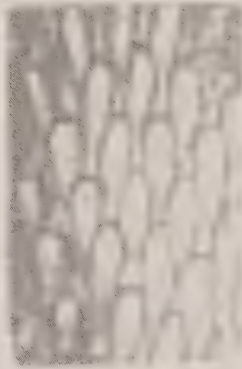
Cystodictya cf. rigida Hall

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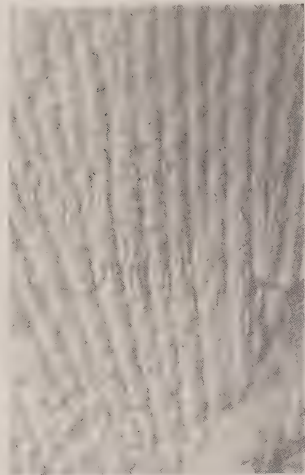
- Fig. 6. Portion of zoarium showing mesathecal surface, natural size.
Fig. 7. Enlargement of horizontal section showing character of zooecia. (X 15.)



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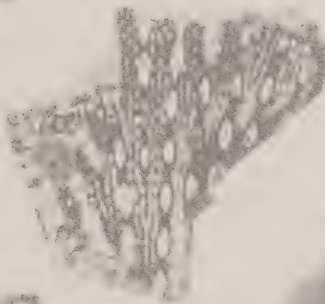
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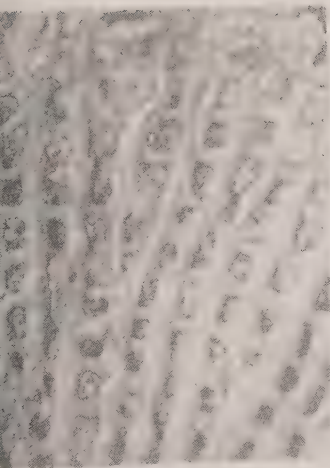
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PLATE NO. 61

PLATE 61

Pholidops ovata Hall

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Figs. 1, 2. Interior moulds of two dorsal valves.

Rhipidomella emarginata Hall

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Fig. 3. Exterior view of pedicle valve.

Figs. 4, 5. Exterior views of two brachial valves.

Rhipidomella musculosa Hall

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Fig. 6. Exterior view of pedicle valve.

Fig. 7. Exterior view of a pedicle valve showing the large, fan-shaped muscular impressions.

Fig. 8. Brachial valve of larger individual.

Dalmanella lenticularis (Vanuxem)

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Fig. 9. Partly exfoliated brachial valve.

Figs. 10, 11. Exterior views of two pedicle valves.

Dalmanella oriskania sp. nov.

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Fig. 12. Exterior view of brachial valve.

Fig. 13. Mould of the interior of a brachial valve, showing the form of the muscular impressions.

Fig. 14. Exterior view of a pedicle valve.

Leptaena ventricosa (Hall)

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Fig. 15. Partly exfoliated pedicle valve, showing muscular imprints.

Fig. 16. Exterior view of pedicle valve.

Fig. 17. Exterior view of brachial valve.

Stropheodonta cf. demissa (Conrad)

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Fig. 18. Exterior view of a brachial valve.

Stropheodonta cf. inequiradiata Hall

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Figs. 19, 20. Views of two pedicle valves.

Stropheodonta missouriensis sp. nov.

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Fig. 21. Interior view of a brachial valve.

Fig. 22. Interior view of an incomplete brachial valve, showing muscular impressions.



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PLATE 62.

Leptostrophia magnifica (Hall)

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- Fig. 1. Exfoliated portion of large pedicle valve.
Fig. 2. Interior view of an incomplete brachial valve showing muscular impressions and pustulose aspect of the vascular area, and crenulations of the hinge line.
Fig. 3. Exterior view of the pedicle valve.

Leptostrophia magniventra Hall

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- Fig. 4. Exterior view of an exfoliated pedicle valve.
Fig. 5. Exfoliated pedicle valve showing form of muscle scars.

Brachyprion cf. majus Clarke

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- Fig. 6. Exterior view of a pedicle valve.
Fig. 7. Interior view of a pedicle valve.

Brachyprion sp.

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- Fig. 8, 9. Interior views of two brachial valves.
Fig. 10. Exterior view of a brachial valve.

Schuchertella sp.

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- Fig. 11. View of an incomplete pedicle valve.

Eatonia peculiaris Conrad

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- Fig. 12. Pedicle view of a large individual.
Figs. 13-16. Brachial, pedicle, lateral and anterior views of a nearly perfect specimen of average size.



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PLATE 63.

Eatonia plicata sp. nov.

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Figs. 1-3. Pedicle views of three individuals.

Fig. 4. Brachial view of an imperfect valve.

Anoplia nucleata (Hall)

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Fig. 5. Internal mould of a pedicle valve. (X 1.5)

Chonostrophia complanata (Hall)

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Fig. 6. Exterior view of a pedicle valve.

Fig. 7. Interior view of a pedicle valve showing muscle scars and pustulose character of the surface.

Uncinulus salinensis sp. nov.

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Figs. 8-9. Pedicle and brachial views of a nearly complete specimen, the holotype.

Fig. 10. Cast of the interior of a pedicle valve.

Uncinulus parvus sp. nov.

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Figs. 11-12. Brachial and pedicle views of the holotype.

Uncinulus welleri sp. nov.

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Fig. 13. Exterior view of a pedicle valve.

Fig. 14. Exterior view of a brachial valve.

Plethorhyncha barrandii (Hall)

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Fig. 15. View of the exterior of a pedicle valve.

Fig. 16. Exterior view of a brachial valve.



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Plethorhyncha principalis (Hall)

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- Fig. 1. View of a nearly complete brachial valve.
- Fig. 2. View of an incomplete brachial valve.
- Fig. 3. View of a small, rotund, brachial valve.

Centronella glansfagea (Hall)

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- Figs. 4, 5. Pedicle and brachial views of a nearly complete specimen.
- Fig. 6. Brachial view of broader individual.
- Fig. 7. Pedicle view of large individual.

Rensselaeria ovoidea (Eaton)

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- Figs. 8, 9. Pedicle views of two small specimens.
- Figs. 10-12. Pedicle, brachial and lateral views of a large, nearly complete specimen.

Rensselaeria cf. stewarti Clarke

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- Figs. 13-15. Views of three pedicle valves.

Beachia suessana (Hall)

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- Fig. 16. Brachial view of a nearly complete specimen.
- Fig. 17. Pedicle view of a second nearly complete specimen.



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PLATE 65.

Beachia ovalis (Hall)

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- Fig. 1. Pedicle view of a nearly complete but exfoliated specimen.

Atrypa reticularis (Linnè)

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- Fig. 2. Brachial view of large specimen.

Rhynchospira attenuata sp. nov.

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- Fig. 3. Pedicle view of the holotype.

Trematospira multistriata (Hall)

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- Fig. 4. Pedicle view of a nearly complete valve.

- Fig. 5. Brachial view of an incomplete valve.

Spirifer arenosus (Conrad)

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- Fig. 6. Pedicle view of a nearly complete valve.

- Fig. 7. Pedicle view of larger specimen.

- Fig. 8. Brachial view of a nearly complete valve.

Spirifer murchisoni Castelnau

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- Figs. 9, 10. Pedicle views of two nearly complete valves.

- Fig. 11. Brachial view of a nearly complete valve.

Spirifer cf. varicosa Hall

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- Fig. 12. View of an incomplete brachial valve.

Cyrtina rostrata Hall

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- Fig. 13. View of an incomplete brachial valve.

cf. Metaplasia pyxidata Hall

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- Fig. 14. View of a pedicle valve. (x 1.5)



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PLATE 66.

Nucleospira cf. ventricosa (Hall)

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Figs. 1, 2. Views of two brachial valves showing the narrow sinus.

Fig. 3. View of an incomplete brachial valve.

Meristella elliptica sp. nov.

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Figs. 4, 5. Views of two pedicle valves.

Meristella ovalis sp. nov.

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Figs. 6-8. Views of three brachial valves.

Meristella ampla sp. nov.

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Figs. 9, 10. Views of two pedicle valves.

Fig. 11. View of the internal mould of a pedicle valve showing the muscular scars.

Meristella carinata sp. nov.

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Figs. 12-14. Brachial views of three individuals.

Figs. 15-16. Posterior views of two nearly complete specimens.

Fig. 17. View of a pedicle valve.

Fig. 18. View of the internal mould of a pedicle valve showing the muscle scars.

Fig. 19. Brachial view of a young specimen doubtfully referred to this species. (X 4).

Figs. 20, 21. Pedicle valves doubtfully referred to this species.

Anoplotheca dichotoma (Hall)

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Figs. 22, 23. Views of two pedicle valves.

Figs. 24, 25. Views of two brachial valves.

Anoplotheca flabellites (Conrad)

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Fig. 26. View of a brachial valve.

Fig. 27. View of a pedicle valve.



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PLATE 67.

Actinopteria insignis Clarke

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Fig. 1. Left valve showing the outline and external characters of the shell.

Fig. 2. Left valve of larger example doubtfully referred to this species.

Actinopteria?

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Figs. 3, 4. Incomplete specimens of two left valves.

Aviculopecten sp. undet.

Fig. 5. Incomplete ventral portion of a left valve.

Orthonychia belli Clarke

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Fig. 6. Lateral view.

Orthonychia tortuosa Hall

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Figs. 7-10. Lateral views of four individuals showing variation in size.



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Orthonychia praeconicum sp. nov.

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Figs. 1, 2. Lateral views of two specimens.

Platyceras angulare Rowe

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Figs. 3, 4. View of the spire and the lateral aspect of a nearly complete specimen.

Platyceras dumosum Conrad

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Fig. 5. Lateral view showing spine bases.

Platyceras elongatum var. *parvum*, n. var.

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Fig. 6. Lateral view of a nearly complete example.

Platyceras gebhardi Conrad

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Figs. 7, 8. Spiral views of two small individuals.

Figs. 9, 10. Lateral views of the same specimens.

Platyceras cf. gracile Ohern

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Figs. 11-13. Lateral views of three individuals.

Platyceras magnificum Hall

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Figs. 14-15. Spiral views of two normal specimens.

Fig. 16. Spiral view of a less ventricose specimen.

Fig. 17. Spiral view of a specimen with the apex of the shell incomplete.



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Platyceras cf. multisinuatum Hall
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Fig. 1. Spiral view of an incomplete specimen.

Platyceras cf. newberryi Hall
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Fig. 2. Lateral view showing character of the surface markings.

Platyceras nodosum Conrad
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Fig. 3. Lateral view of a small individual showing nodes.

Figs. 4, 5. Spiral and lateral views of a mature specimen.

Fig. 6. Umbilical view of an incomplete specimen.

Platyceras reflexum Hall
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Figs. 7-9. Spiral views of three specimens showing variation in size.

Platyceras retrorsum Hall
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Fig. 10. Spiral view of a nearly complete specimen.

Platyceras cf. subconicum Ohern
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Fig. 11. Lateral view of an incomplete specimen.

Platyceras trilobatum Hall
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Fig. 12. Spiral view of a specimen incomplete in the apical part.

Platyceras peregrinus sp. nov.
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Figs. 13, 14. Spiral and lateral views of an incomplete specimen, showing the much compressed form.

Platyceras depressum sp. nov.
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Figs. 15, 16. Spiral and lateral views showing the compressed and subangular outline of the shell.

Hyolithes cf. oxys Clarke
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Fig. 17. View of the convex face of an incomplete specimen.

Tentaculites elongatus Hall
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Fig. 18. Lateral view of the internal cast of a specimen. Natural size.



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PLATE 70.

Platyceras planovolvis sp. nov.
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- Figs. 1-3. Spiral views three specimens showing variation in size.
Fig. 4. Umbilical view of a sinistrally coiled specimen.
Fig. 5. Umbilical view of a larger, dextrally coiled specimen.

Diaphorostoma ventricosum (Conrad)
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- Fig. 6. Lateral view of small specimen.
Figs. 7, 8. Lateral and spiral views of a large specimen.

Strophostylus allani sp. nov.
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- Figs. 9-15. Spiral views of two small specimens.
Figs. 11, 12. Lateral views of the same specimens.
Figs. 13, 14. Lateral and spiral views of a large specimen.
Fig. 15. Lateral view of a smaller specimen.

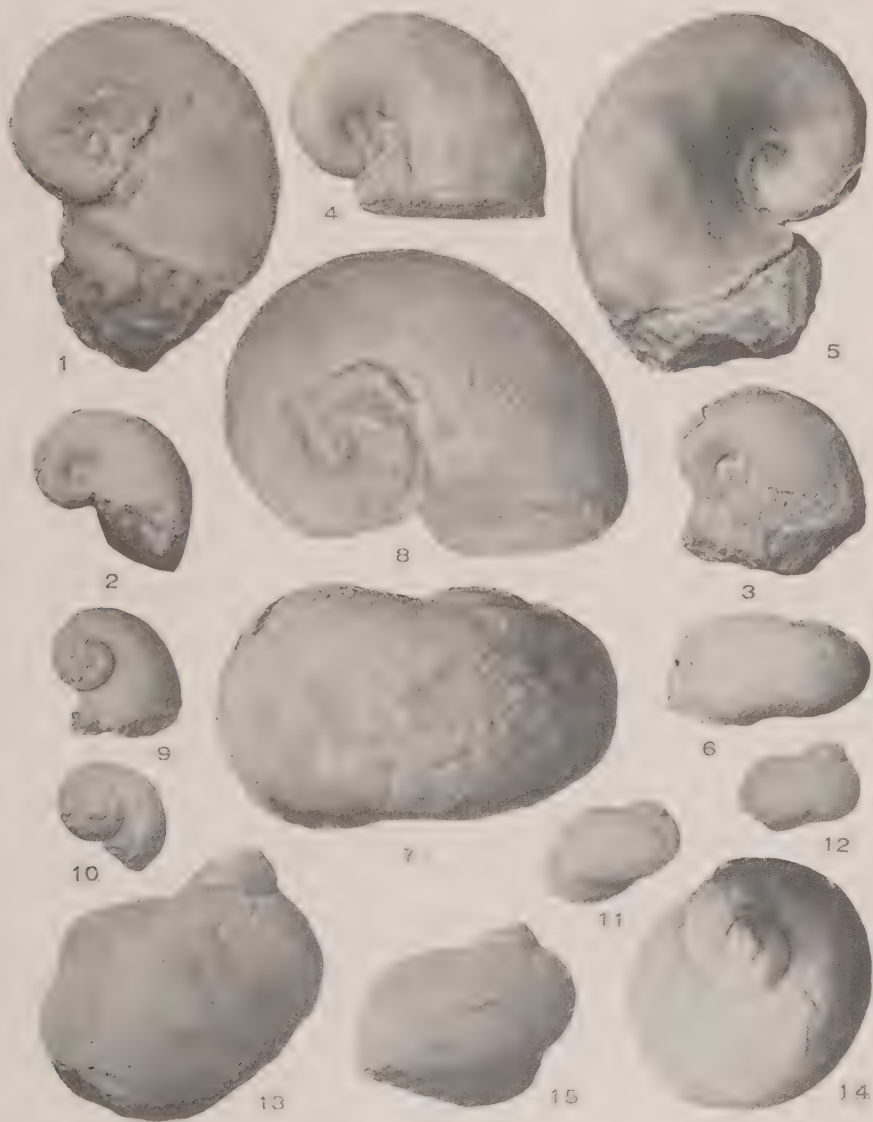


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Acidaspis sp. undet.

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Fig. 1. View of an incomplete cephalon.

Proetus conradi Hall

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Fig. 2. View showing the glabella and the marginal border.

Proetus cf. *pachydermatus* Barrett

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Fig. 3. View of an incomplete cephalon.

Proetus protuberans Hall

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Figs. 4-6. Three pygidia of different sizes.

Fig. 7. View of a glabella with portions of the cheeks.

Lichas sp.

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Figs. 8, 9. Two fragments of the test of a large lichad.

Dalmanites cf. *aspinosus* Weller

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Figs. 10, 11. Two incomplete pygidia.

Dalmanites cf. *bisignatus* Clarke

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Fig. 12. View of an incomplete pygidium.

Ceratolichas gryps Hall

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Figs. 13, 14. Front and dorsal views of a nearly complete cranium from the Grand Tower limestone of Illinois.

Fig. 15. Glabella of larger specimen from the Little Saline limestone.

Dalmanites cf. *pleuroptyx* (Green)

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Fig. 16. View of an incomplete pygidium.

Dalmanites cf. *stemmatus* var. *convergens* Clarke

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Fig. 17. View of a nearly complete pygidium.

Dalmanites sp.

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Fig. 18. Anterior margin of the cephalon.

Dalmanites praenuntia sp. nov.

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Fig. 19. View of pygidium showing the slightly bilobed posterior margin.

Dalmanites slocomi sp. nov.

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Fig. 20. View of a nearly complete pygidium.

Cryphaeus sp.

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Fig. 21. View of a nearly complete pygidium with the spines broken off.

Dalmanites micrurus? (Green)

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Fig. 22. Incomplete cephalon showing the tuberculate surface.

Phacops cristata Hall

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Fig. 23. Dorsal view of a large cephalon.

Figs. 24, 25. Dorsal view of a cephalon and an incomplete pygidium.

Phacops sp.

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Fig. 26. A nearly complete pygidium.

